THE

FOUNDRY TRADE JOURNAL

WITH WHICH IS INCORPORATED

THE IRON AND STEEL TRADES JOURNAL

VOL. 46. Thursday, March 31, 1932. No. 815.

PUBLISHED WEEKLY.

Subscription Terms: 15s. per annum.
Foreign and Colonial: 17s. 6d. per annum.
All Subscriptions are payable in advance.

All Communications to be addressed to the Editor, the Advertisement Manager, or the Publisher of

THE FOUNDRY TRADE JOURNAL,
49, WELLINGTON STREET, LONDON, W.C.2.

Telegraphic Address: "Zacatecas, Rand, London."
Telephone: Temple Bar 3951 (5 lines).

Contents.

	PAGE
Forthcoming Events	199
Fuel Research	199
Mechanisation and Elasticity	199
Iron and Steel Institute	200
Publication Received	200
Soy Bean Oil for Cores	200
French Exchange Paper	200
Random Shots	200
Light-Castings Problems	201
Impact Tests for Cast Iron	204
The Testing of Castings	205
The "Qualcast" Annual Dinner	207
John Surtees Memorial	208
Improvement of High-Alloy Austenitic Nickel-Chrome Steel by Carbide Precipitation Hardening	208
The Setback in Spelter	209
Corrosion of Iron and Steel	209
Inclusions in Steel	209
Metallographic Testing Standards	209
This Week's News in Brief	210
Trade Talk	210
Personal	210
Company Reports	210
Contracts Open	210
Obituary	210
Fatigue of Metals	210
Rotary Melting Furnaces	210
New Companies	210
Raw Material Markets	212
Catalogues Received	212

THE FOUNDRY TRADE JOURNAL IS THE OFFICIAL ORGAN OF THE INSTITUTE OF BRITISH FOUNDRYMEN; THE WELSH ENGINEERS' AND FOUNDERS' ASSOCIATION, AND THE FOUNDRY TRADES' EQUIPMENT AND SUPPLIES ASSOCIATION.

Institute of British Foundrymen.

PRESIDENT: 1931-32:

A. Harley, The Daimler Company, Limited, Daimler Works, Coventry.

LIST OF SECRETARIES—

General Secretary: T. Makemson, Saint John Street Chambers, Deansgate, Manchester. London Office: 49, Wellington Street, London, W.C.2.

Birmingham: F. K. Neath, 24, St. Paul's Square, Birmingham.

Sheffield: T. R. Walker, 33, Ladysmith Avenue, Nether Edge, Sheffield.

Scottish: J. Bell, 60, St. Enoch Square, Glasgow.

Lancashire: J. E. Cooke, 1, Derbyshire Crescent, Stretford, Manchester.

London: H. W. Lockwood, Stewarts & Lloyds, Limited, Winchester House, Old Broad Street, London, E.C.2.

Newcastle-upon-Tyne: J. W. Eckford, 4, Mosley Street, Newcastle-upon-Tyne.

East Midlands: H. Bunting, 82, Otter Street, Derby.

West Riding of Yorkshire: S. W. Wise, 110, Pullan Avenue, Eccleshill, Bradford.

Wales and Monmouth: J. J. McClelland, 12, Clifton Place, Stow Hill, Newport, Mon.

Middlesbrough: F. A. Harper, "The Briars," Bishopton Road, Stockton-on-Tees.

Foundry Trades' Equipment and Supplies Association.

President: D. H. Wood, Titan Works, Charles Henry Street, Birmingham.

Secretary: K. W. Bridges, Grand Buildings, Trafalgar Square, London, W.C.2.

Welsh Engineers' and Founders' Association.

Secretary: E. J. Griffiths, 2, Royal Metal Exchange, Swansea.

BRITISH CAST IRON RESEARCH ASSOCIATION.

The Registered Office and Laboratories of the B.C.I.R.A. are at:—
24, ST. PAUL'S SQUARE, BIRMINGHAM.
Telephone: Central 1895. Telegrams: CIRA.
The B.C.I.R.A. Scottish Laboratories are:—
Foundry Technical Institute, Meek's Road, Falkirk (*Telephone 332*).

Forthcoming Events.

APRIL 8.

Society of Chemical Industry (*Chemical Engineering Group*):—Ordinary meeting at Sheffield. "Special Alloy Steels as Applied to Chemical Engineering." Paper by T. G. Elliott, F.I.C., R. J. Sarjant, M.Sc., and Wm. Cullen.

Institute of British Foundrymen.

APRIL 8.

Middlesbrough Branch:—Annual general meeting, and general discussion.

APRIL 9.

East Midlands Branch (*Lincolnshire Section*):—Annual general meeting, and open discussion on "Foundry Problems."

Fuel Research.

That we should look forward to the Annual Reports of the Fuel Research Board testifies to the useful work which that body is doing. Since the last report was issued the Director of Fuel Research, Dr. Lander, who followed Sir George Beilby in 1923, has retired and has become Professor of Mechanical Engineering at the Imperial College of Science and Technology. He has since been succeeded by Dr. F. S. Sinnatt, who has been Assistant Director.

The work of the Board now covers a very wide range, but this is probably by no means too wide when it is remembered that coal is our greatest and most important mineral asset. In view of our almost entire lack of natural oil resources, treatment of coal furnishes the only means at our disposal of obtaining the necessary oils, both heavy and light, for internal-combustion engines, and this offers the sole prospect we have of making us independent of foreign oil supply. This alone would make an enormous difference to the adverse trade balance, and it is very significant that during the last few weeks it has been rumoured that Germany is about to take a step in this direction by a system of import licences for imported oil, and by co-ordination and encouragement of all the home sources of supply. Part of the Board's report deals with the development in the Bergius process, which originated in Germany, for the hydrogenation of coal. The original process produced a rather tarry liquid by treating the coal with hydrogen under high pressures and temperatures at about 450 deg. C. Experiments have shown that a yield of 125 galls. per ton of coal substance treated, and Imperial Chemical Industries have stated that they can obtain 165 galls. of motor spirit per ton of coal treated. The process is not yet commercial in the sense that it can provide material in sufficient quantity and price to compete with the imported article, but it does show that in the event of restriction of supplies, such as occurred during the war, a source of motor spirit is available.

In addition to the Headquarters Staff and the Fuel Research Station at Greenich, there are now seven laboratories on the various coalfields in connection with the national survey of coal resources. We do not know offhand how much money has been spent by the Fuel Research Board since it began, but the benefits are bound to be received not only by the coal consumer, *i.e.*, by the ordinary citizen, but also by the coalowner, and it is difficult to understand why the metallurgical industries are having to fight to secure their slender funds from the State for metallurgical research, in view of the magnificent provision made for the coal industry.

Whatever the future may hold it is essential for us to use coal as our primary source of power, and our future as an industrial nation depends largely on the intelligence with which this is done. It can be safely prophesied that the days of the use of raw coal are numbered.

Mechanisation and Elasticity.

No one has been more pertinaceous in the advocacy of mechanisation than ourselves, but we have invariably stressed the need for elasticity. Smalley, when writing a review of American business conditions in 1931, pointed out very forcibly that it was the large quantity-production plants which had suffered most during the slump, whilst the jobbing foundries could still carry on. It is now apparent that a number of American and some Continental plants had created installations capable of making "big" money when running at capacity, but the index figure where profits ceased and losses commenced was quickly reached with decreasing output. Yet those in control of such plants knew to probably within 1 per cent. of the capacity-decrease figure where the crucial point was situated, but they banked on continuous and continual "boom-trade" conditions. Insufficient publicity has been given to Mr. E. J. Fox's precepts that the correct size for an industrial unit could be determined by: (1) It should be large enough to carry an efficient sales organisation and (2) it should be large enough to avail itself of mechanical aids. We feel that a third precept is essential, which would read "that it should be so organised that it can return a profit on its capital when operating at a low-percentage output." To achieve that last enunciated precept, the great factor to be borne in mind is "elasticity" in the design of the plant. It may cost more money initially to install a number of small manufacturing units than one large one, but it constitutes an excellent safety valve for periods of short-time working. This operation also applies to commercial organisations, and only recently one of the largest steelmaking trusts in Europe has decentralised its selling organisation in order to instil into it the great factor of personal attention to the customers' requirements. The lesson to be learnt from current industrial conditions is now quite clear. To progress the works must be mechanised, but this operation must be so intelligently designed as to admit of the greatest elasticity of working to take care of the divergent demands upon its capacity.

XUM

Iron and Steel Institute.

ANNUAL MEETING, 1932.

The annual meeting of the Institute will be held, by kind permission, at the Institution of Civil Engineers, Great George Street, Westminster, on Thursday and Friday, May 5 and 6, 1932, commencing each day at 10 a.m.

The following is a list of Papers expected to be presented at the meeting:—

"Fourth Report on the Heterogeneity of Steel Ingots," by a Joint Committee of the Iron and Steel Institute and the National Federation of Iron and Steel Manufacturers.

"The Action of Sea-Water on Mild Steel," by G. D. Bengough and A. R. Lee.

"The Lattice Spacings of Iron-Aluminium Alloys," by A. J. Bradley and A. H. Jay.

"Blast-Furnace Engineering," by W. R. Brown.

"The Properties of some Silico-Manganese Steels," by G. Burns.

"The Austenite $\rightleftharpoons$ Pearlite Inversion," by Sir H. C. H. Carpenter, F.R.S., and J. M. Robertson.

"The Theory and Practice of Nitrogen Case-Hardening," by A. Fry.

"Some Experiments on the Nitrogen Hardening of Cast Iron," by J. E. Hurst.

"The Heterogeneity of a Sand-Cast Steel Ingot," by A. Kriz.

"The Determination of the Porosity of Tin Coatings on Steel," by D. J. MacNaughtan, S. G. Clarke and J. C. Prytherch.

"Behaviour of Manganese in the Acid Open-Hearth Process," by E. Maurer and W. Bischof.

"The Influence of the More Common Elements in Inhibiting Needles in Nitrogen-Rich Steels and Arc Welds," by L. W. Schuster.

"Recent Improvements in the Greenawalt Sintering Apparatus," by J. Tornblad.

Annual Dinner.—The annual dinner will be held in the Grand Hall of the Connaught Rooms, Great Queen Street, W.C., on Thursday, May 5, at 7 for 7.30 p.m.

Autumn Meeting.—The autumn meeting of the Institute will be held in London on Tuesday, Wednesday and Thursday, September 13, 14 and 15, 1932. The meeting will take place concurrently with that of the Institute of Metals and the sessions will be held by kind permission at the Institution of Civil Engineers, Great George Street, Westminster.

Publication Received.

Handbook for Electric Welders. Published by Murex Welding Processes, Limited, Ferry Lane Works, Forest Road, Walthamstow, London, E.17. Price 1s. net.

It should be realised that, as the publishers of this book are manufacturers of electrodes, the editor uses the firm's brands as illustrative matter. This does not really detract from the value of the book from a technical point of view. There is an excellent article by Mr. J. Clarke on "Welding Cast Iron," which is devoted to actual repairs—not the filling in of any surface defect. Actually we think the book would be improved by the inclusion of some matter written specially for the iron and steel founder in reference to the treatment of surface defects.

Seaco Manganal Electrodes.—For building up and reclaiming 11 to 14 per cent. manganese steel castings by the electric arc welding process, the Stulz-Sickles Company, 134, Lafayette Street, Newark, N.J., has developed a special electrode known as the Seaco Manganal. This electrode, it is stated, will not remove the effects of the heat-treatment through which manganese-steel castings are put to assure maximum resistance to impact and abrasion. It is described as being of modified manganese steel alloyed with special minerals which have a definite relation to the carbon content in 11 to 13½-per cent. manganese steel.—"The Iron Age."

French Exchange Paper.

Mr. J. Pillon, the author of the Exchange Paper to be presented on behalf of the Association Technique de Fonderie to the Newcastle Conference to be held in June, is a Chevalier of the Legion of Honour. He was trained at the Arts et Métiers School and Ecole Centrale de Paris as a Civil Engineer. Since graduating, he has devoted his career to both industrial activities and also to teaching. He is responsible for a course of lectures at the Ecole Centrale on Practical Applied Mechanics, and collaborates with Mr. Ronceray in the adjustment of the scientific courses with practical work at the Paris Foundry High School and has instituted thereat a teaching course, of which his Paper will be an extract.

Mr. J. Pillon.

Soy Bean Oil for Cores.

An investigation of the suitability of soy bean oil for making cores was conducted by the Engineering Experiment Station of the University of Illinois. The results are published in Bulletin No. 235.

The following conclusions are drawn: Raw soy bean oil produced cores with an average tensile strength slightly higher than the average tensile strength of cores made from semi-refined or varnish soy bean oil. The addition of kerosene to raw soy bean oil caused a gradual reduction in the average tensile strength of the cores as the percentage of kerosene in the mixture was increased. The addition of Japan drier to raw soy bean oil slightly increased the tensile strength of the cores. Various additions of both Japan drier and kerosene to raw soy bean oil produced cores with varying tensile strengths which followed no definite rules over the range of data collected. Cores made with mixtures of linseed oil, kerosene, and soy bean oils decreased in strength as the percentage of kerosene and soy bean oil were increased. The tensile strength of the cores made with the soy bean oils, and mixtures of soy bean oil and kerosene, was found to be proportional to the iodine numbers of the soy bean oils and mixtures of soy bean oil and kerosene.

Random Shots.

What "Marksman" Would Do.

If I were a Frenchman and owned a café in Paris, I would put in my window the notice "Ici on ne parle pas français," I would christen my café either "Ye Olde Eatyng House" or "Caveat Emptor," and I would do a handsome business.

* * *

The Reason Why.

Because I have read books on psychology I would do these things.

* * *

Pabulum for Patrons.

I anticipate that my patrons would fall into two main classes: there would be English visitors to Paris, there would be Parisians in Paris. Let me particularise. In saying English visitors, I refer to those essentially English people whose gooses have been Cooked. Imagine them passing disconsolately the Café Guerbois, the Café Riche and other dangerously foreign-looking restaurants and alighting upon "Ye Olde Eatyng House." There they could resume interrupted acquaintance with the comfortable familiarities of roast beef and Yorkshire pudding and boiled potatoes and boiled cauliflower. In saying Parisians in Paris, I refer to those Parisians who correspond, more or less, to those Londoners whose passion it is to visit the adventurously foreign-looking cafés of Soho. Imagine them alighting upon "Ye Olde Eatyng House" and there making acquaintance with such picturesque and exciting dishes as roast beef and Yorkshire pudding and boiled potatoes and boiled cauliflower. The more I think of this "Ye Olde, etc.," scheme, the more profitable it seems to become.

* * *

Sad but True.

Commercial travellers are to-day the most independent of business men. They take orders from hardly any one.

* * *

Vagaries of Journalists—I.

"To-day I have seen two of the immense eight-ton bronze doors for the reconstructed Bank of England being cast in London. White-hot flames leapt out of pit furnaces, and roared from blast furnaces standing like soldiers on parade. White dust lay everywhere."

* * *

Vagaries of Journalists—II.

"I went to see the casting of the great bronze doors which are to be the new entrance of the Bank of England. We went down to the foundry, where six blast furnaces, two of them underground, had been making molten the metal for one leaf of the double doors."

* * *

Blast-Furnace Enigma.

Both writers seem to have tripped up, so to speak, over the blast furnaces. The thought of two blast furnaces underground conjures up visions of a "Fritz Lang-Metropolis" sort of ironworks. And as for furnaces standing in a row like soldiers on parade, that, surely, must be one of the lesser-known sights of London. But, when one comes to think of it, aren't lots of our blast furnaces just like soldiers on parade? Chiefly engaged, that is, in doing nothing?

Marksman.

Light-Castings Problems.*

By G. Moran.

Though problems of the light-castings industry cover a wide range, practical, technical, economic and administrative, yet in many essentials they do not differ from the heavier or allied casting trades, being characteristic in their elements, methods of production and scientific principles. Customers have to be satisfied that production charges which govern selling prices are reasonably economic—then they are firmly impressed that any business can with assurance be safely left in the hands of a foundry. They realise that, as regards quality, service and price, when both parties are satisfied, one half of the industrial battle is already won, and out-

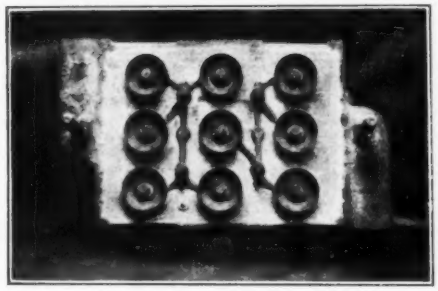


Fig. 1.—Plate-Patterns for Machine Moulding.

side competition is not then sought. To attain this desirable consummation, which is by no means improbable and in fact is often achieved, requires careful thought, concentration and attention to detail.

The following remarks represent the view of the jobbing founder, who undertakes all kinds and quantities, of innumerable variety and mixtures, and whose experience, consequently, is more widespread than the specialist in one line, whom he envies in this respect only.

There is probably more of interest, technical and practical, in the founding industry than in any other profession; its essentials are so numerous and varied, its ramifications and applications so wide there is scarcely any trade which does not rely upon its products for some important feature and in some shape, size or form.

There are so many channels for scope: the *foundry proper*, and its endless variety of castings of all sizes and sections; *core-making*, green and dried, sea-sand and sharp; *sand-mixing* (a fine art of boundless possibilities); *pattern-shop practice*, the interpretation of drawings and blue prints; *cupola practice*, the charge and mixings, linings, daubing, suitable fuel and correct proportion for economic purposes, tapping and casting temperatures, ensuring sound products, each constituting vital problems for due consideration

Keen perception, knowledge and understanding of one's fellow workers are essentials; that is, treating everybody in the concern as one of the family, working *with* you and not *for* you. Half the troubles of the existing generation are a lack of appreciation of the sterling qualities of the finest workmen in the world, far too many of whom were compelled through lack of opportunity to migrate to foreign lands, forming the nucleus of opposition instead of co-operation. It is best to fix prices and adhere to them. If the operative gives of his best and earns well, remember the selling prices are based on what the management is paying, do *not* cut it down, because the more production obtained, the lower the overhead or dead charges in proportion.

The Human Element.

One of the most important points in light castings of sections ¼ in. or less (customers, by the way, look upon it as *the* most important) is the question of machinability; this is quite easily attained with ordinary compositions of pig-iron and without the necessity of purchasing any special brands at excessive prices, such as scrap-absorbing products, which are merely high-silicon irons and are almost the last thing desirable, as slow cooling is the essential factor.

It is always desirable to have the choice of (say) three ranges in the stock yard, working preferably on a silicon basis. Strong iron of 1.25 per cent. or thereabouts; medium, which may be called the average or standard supply, with 2 to 2.5 per cent.; and soft, with about 3 per cent. Si. The first and third are for occasional use as necessity demands, the second is the general and regular standby, and if required to strengthen or tone down a proportion of one or the other is added.

Whilst strongly and emphatically recommending scientific control where possible, one must recognise and appreciate the views of small manufacturers, who say with truth that all blast-furnace pig-iron producers sell to analysis, and these in most cases are reliable. It is a fact that standard brands can be depended upon to be quite regular, and the cost of installing and maintaining a laboratory, to a foundry buying from 10 to 20 trucks of pig-iron *per year*, would be out of all proportion to the selling price obtainable, but where quantity warrants it is folly not to incorporate the desirable adjunct. Pig-iron, fuel, ganister, limestone and all purchases should be rigidly and regularly analysed and controlled, as should all products, to ensure that uniformity, which is the essence of success. By normal everyday practice it is possible to obtain a definite and regular product from the cupola.

According to Moldenke, "when the fuel bed in the cupola is allowed to sink too low during a heat, the metal is forced to melt too close to the tuyeres, with the resulting oxidation of not only the silicon, manganese and carbon, but also of much iron. This iron oxide attacks the lining, and with ash and sand present from the coke and pig-iron charges gives a copious 'foaming' slag. The blast takes this upward and sends it out of the charging door. If the blast is shut off this slag drops again and floods the windbox through the tuyeres, making a nasty mess of it. Hence the supreme importance of melting in the proper position of the cupola, above the tuyeres. It is the basis of successful cupola practice."

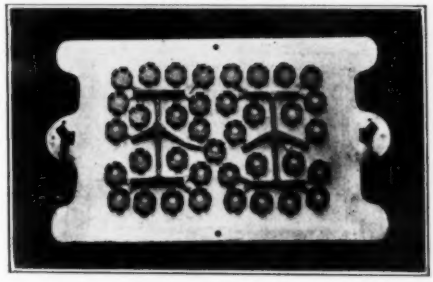


Fig. 2.—Plate-Pattern for Snap Flask Moulding.

Light castings require a hot fluid metal and should be left in the mould until thoroughly cool; if the combined carbon in a casting runs below 0.6 per cent., machining is reasonably easy, if 1 per cent., machining becomes difficult, and at 1.5 per cent. it becomes impossible, as ordinarily understood.

First and foremost, one must decide on a standard size of box, whether for snap-flask or machine, say 16 in. by 12 in., together with a half-size (12 in. by 8 in.), which, when two are fastened together, conform to standard. Obviously, it is not always possible to keep to this standard for machine work, but almost without exception, it is maintained for snap flasks, or what is known in foundry parlance as "stump moulding." Having thus decided, then

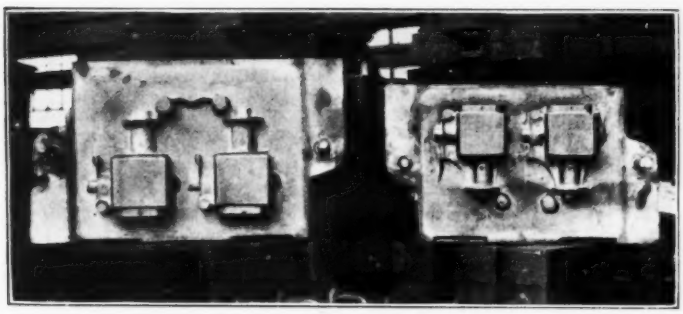


Fig. 3.—Showing Method of Mounting Patterns for Plate-Moulding for Doubling Production.

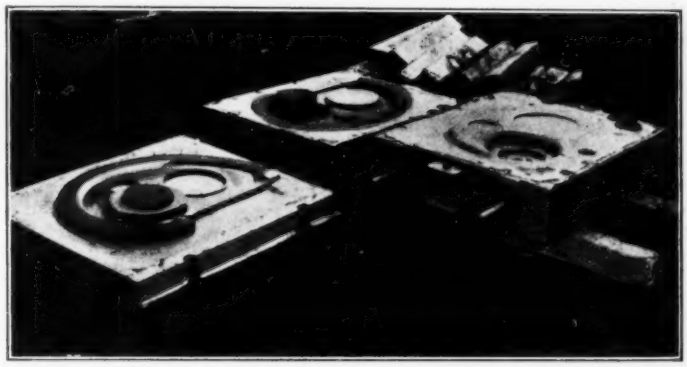


Fig. 4.—Typical Plaster of Paris Patterns.

* Paper read before the Wales and Monmouth Branch of the Institute of British Foundrymen.

the question is: how many patterns can be accommodated with due allowance for runners and down gates?

The jobbing foundry envies the concern which has a profitable output in a line of product worked by mass production and no change of mixture, yet such concerns envy the skill necessary in a jobbing foundry where mere automatons have little or no space, every pattern differing and requiring its own consideration for production and mixing according to section. It is

Fig. 5 shows Two Castings, one Defective through Mal-Proportioned Runners, and the other Sound after Enlarging the Runner.

nothing unusual to have five or six different mixtures per day, ranging from light electrical work of ¼-in. section, or even less, to machinery or die castings up to 3 in. and involving uneven sections.

Cardinal principles for jobbing foundry practice are:—(1) Aim to produce only high-grade work; (2) sell at the top figure the market will bear, this involving good salesmanship; and (3) ascertain costs to the smallest necessary detail. The cost system should show in the simplest and quickest way, just what is needed to get reliable results.

When the administrative head of an iron foundry receives an inquiry for his products, he is faced with a chart, simple in its way, but which summarises a store of information, the concentrated essence of experience, and this chart (Table I) should be noted carefully, because it forms the whole basis of the structure, variable and invariable, upon which the success or non-success of the business depends.

This does not mean that the formula is followed by everybody in this form; larger concerns have a more elaborate, detailed, and many times sub-divided system (each one employing a staff) which, however, is boiled down to a percentage on production, and therefore amounts to the same thing. Others work by rule of thumb, producing and selling with little, if any, idea of cause and effect, as long as they are on the right side at the end of the year, and if, as often happens, in slump or bad times, they not only do not show a profit, but a substantial loss, they wonder why.

The chart (Table I) needs constant check and supervision due to possible fluctuations in prices of raw materials, and consequently in finished products.

The iron as pig costs 70s. per ton delivered at works, but as good machinery scrap can be purchased for a considerably lower figure, and the production can safely utilise a large proportion, depending on the particular job, one can thus enter a reduced figure on the chart. This does not apply to malleable iron.

Table I.

Materials. £ s. d.	*Per Ton.*	*Labour Wages.* £ s. d.
3 0 0	Iron (50/50, Pig at 70s., Scrap at 50s.)	
0 3 0	Waste, 5 per cent. (melting losses)	
	Making (actual) 7 lbs. : 3d. : : 112 = $\frac{336}{7}$ =	4 0 0
	Cupola, 20 tons p.w., 2 men, £9	0 9 0
0 10 9	Coke (including bed), 43s. per ton, 5 cwts. to 1 ton of iron)	
0 10 0	S. T. W. (Limestone, ganister, bricks, lining)	
	Fettling and sand-blasting (Tonnage-wages)	0 10 0
	Cores (varying)	0 5 0
4 3 9		5 4 0
	E.C's 100 per cent. on productive wages ..	5 4 0
	Materials	4 3 9
	Prime cost	14 11 9
	Profit, 20 per cent. ..	2 18 4
		17 10 1
	Add, carriage	
	Agent's Commission ..	
	Discount	
	Selling price	

Every concern has a system of rating, piece work or day work, invariably based on tonnage, a standard price for a standard mould, varying according to its nature, whether plain, intricate, cored, light or heavy. If 3d. is the price per mould, and the weight of the castings 4 lbs., a simple calculation:—

$$4 : 3 : : 112 = \frac{336}{4} = 84\text{d.}$$

will show this to be 7s. per cwt., £7 per ton. Should the castings weigh 8 lbs., the price will be proportionate, $8 : 3 : : 112 = \frac{336}{8} = 3\text{s. } 6\text{d.}$ per cwt., £3 10s. per ton, hence the difference between the selling price of large or small, heavy or light castings.

Fuel.

One has to know the total amount of coke consumed per ton of iron for the calculation. Assuming 5 cwts. per ton at 43s. per ton, it gives 10s. 9d. per ton of iron; this is, obviously, a variable item, either for price or quantity.

The next item (S. T. W.) calls for detailed explanation; sand, tear and wear actually means all the essentials which cannot be allocated to one specific charge, but are necessary for the working of the system. It includes cupola bricks, ganister for ramming, limestone, sand, coal dust, etc. Wear and tear can be reckoned for any period on tonnage, in so far as they relate to casting materials.

Fettling, or dressing, is self-explanatory, and easily arrived at by dividing tonnage by wages.

Cores may be a serious proportion of the job, as, for example, in motor-cylinder manufacture, or only an insignificant item. It will be found, almost without exception, that each one calls for separate consideration and calculation.

It will now be seen that the system has arrived at a stage when those using it can satisfy themselves what the materials and labour are to cost. The next item is perhaps the most important in the whole procedure, that is, E.C.'s or overheads, as it embodies rent, rates, taxes, insurance, salaries, non-productive wages such as patternmakers, warehouse, office, maintenance, repairs and so on, and is usually based on tonnage produced, or as a percentage on productive wages. Particular attention is called to this, because on their proper understanding and function so much depends.

One should satisfy oneself, therefore, that for every £1 spent on "productive" wages a similar amount is necessary to cover overheads, so one adds 100 per cent. to the former, plus the materials, and arrives at the prime cost. The management has now to decide what margin of profit its commodity will stand. If one was dealing in gold, platinum or some of the rare metals, maybe 1 or 2 per cent. would provide ample remuneration, but a cheaper article, such as iron, necessarily requires considerably more to cover all the possible risks inherent to the business, and one decides on (say) 20 per cent.

An inquiry may call for the goods to be packed and delivered English port, or a distance of

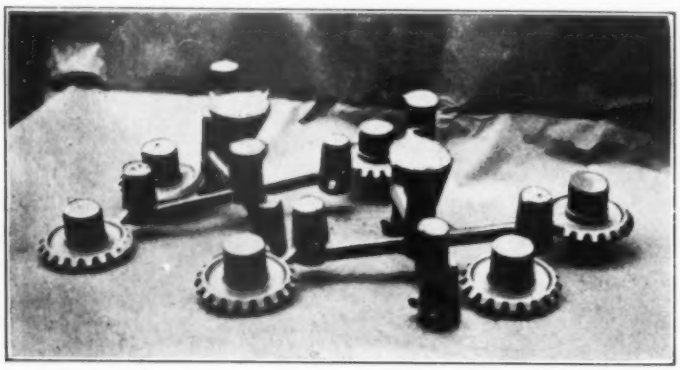


Fig. 6 shows Two Sprays of Defective Castings due to Smallness of Risers.

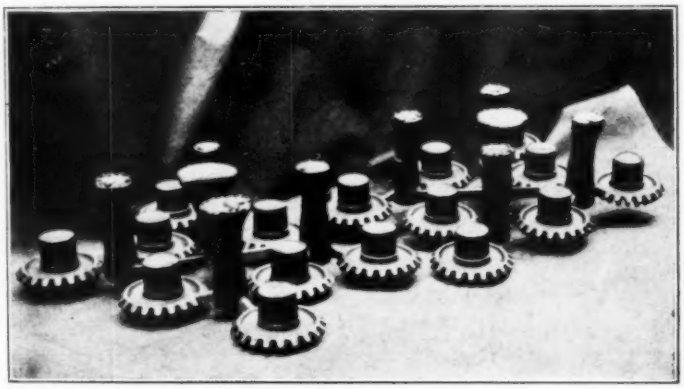


Fig. 7.—Here the Defect shown in Fig. 6 has been Eliminated by Heavier Risers.

Waste or melting losses can be calculated and substantiated by trial, in the larger concerns daily by difference in the weight charged, resulting castings, sprues and runners; and in smaller foundries by actual periodical test, and checked by weekly or monthly returns. This shows the necessity of keeping up-to-date records, without which hopeless confusion prevails.

Labour Charges.

100 railway miles, and this extra is added, as is also commission to the selling agents, and thus one arrives at the price which *should* be obtained for the goods.

Patternmaking.

A blueprint, from the original drawing, is usually supplied to the patternmaker; this entails draughtsmanship of the first order, a highly-skilled occupation, as so much depends upon correct dimensions, proportion, section and coring. The patternmaker must know whether the pattern to be made is for production, or a master for making working patterns, as due allowance must be given for contraction in aluminium, gun-metal or iron. A pattern metal, consisting of an alloy cited by The Foundry Trade Journal, which is almost non-contracting, consists of 40 per cent. Sn, 17 per cent. Sb, 40 per cent. Pb, 1 per cent. Cu and 2 per cent. Bi. Aluminium patterns are particularly useful for operatives, by virtue of lightness; they may considerably increase output, through workers not being fatigued by continual lifting of a heavy spray of patterns. It should be understood that a man will make upwards of 70 moulds per day, which he also has to cast and knock out.

From the master pattern one now proceeds to make the necessary working patterns, according to the number of castings required and the method of production—whether for plate-moulding, plaster-of-paris oddside, or single working. Quite a number of factors enter into consideration at this point, as, for instance, quantity, which is the most important, for on this hinges the whole procedure. Assuming that some thousands of castings are quoted for and ordered, the management has then to decide how they are to produce economically. Obviously a uniform and consistently regular article is required for engineering, electrical, or similarly important trades, where expensive jigs are supplied to the operatives; these men are probably paid on piecework rates and rely upon consistent castings for their wherewithal. Obviously any variation in size, dimension, machinability, section, etc., profoundly affects the earning capacity of the operatives, whilst production in the shop reflects itself correspondingly and in a very short time returns to the source, with far-reaching consequences.

Thus the author in such conditions would decide on plate-patterns such as are illustrated in Figs. 1 and 3. These may appear expensive, but, in view of the nature of the work, unavoidable, and first cost is final. In case of necessity, production can be doubled by the method indicated in Fig. 3.

Here a further stage of metal-patternmaking enters, again, a highly-skilled occupation, which requires precision, judgment, a sound knowledge of foundry practice and the human element, so as to make production as near foolproof as possible. The metal patternmaker must know where to place the ridges or runners, risers, spinners if necessary, and also how many patterns can be conveniently and economically accommodated; whether for snap-flasks, with or without binders, or in iron moulding boxes, where there is less fear of the molten metal bursting through the sand, in fact, every consideration which gives maximum production with minimum loss or waste must be envisaged. Being satisfied by trial that the product conforms to all requirements, specification, weight, cost and the like, one is ready to proceed with the millions desired and never attained.

Alternately, a cheaper, but none the less useful form of production, is by plaster of paris moulds. As many metal patterns and ridges as possible are laid true—an essential—on a sand mould, parting powder is shaken well over, and a covering of oil is carefully brushed on to prevent sticking. A rigid box part about 2 to 3 in. deep is placed over, plaster of paris is run in and allowed to set, which it does very quickly. At a suitable moment, and when in the plastic state, it is levelled off, turned over, and the patterns and ridges extracted. The reason and value of the oil-covering will be apparent, for without this the mould would crumble, whereas each pattern is lifted out cleanly and a perfect impression and joint are left. When the mould is thoroughly dried, the patterns and ridges are replaced, soldered up, finishing touches applied, and it is ready for production. Such a pattern is shown in Fig. 4.

The importance of correct gates and runners has already been emphasised, but certainly not too strongly, as this is a phase upon which too

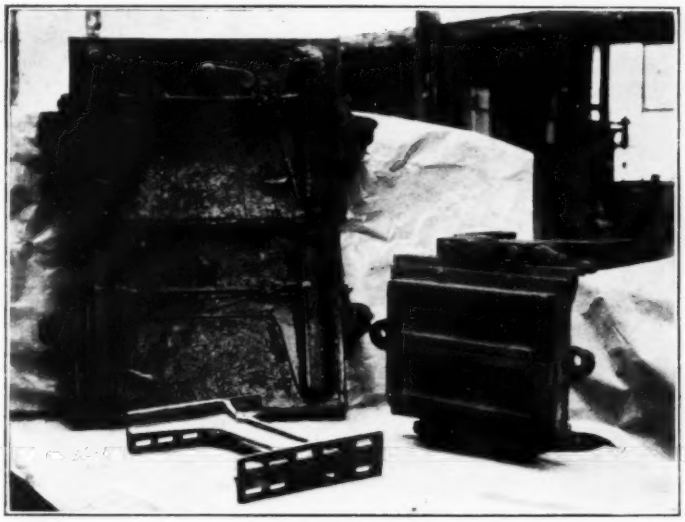


Fig. 8 Illustrates a Core Box for Machine Production.

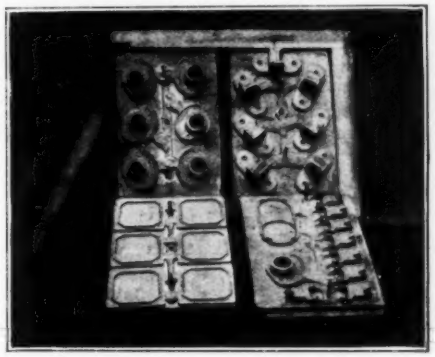


Fig. 10.—Showing Means Adopted for Making Two Small Plates into One of Standard Size.

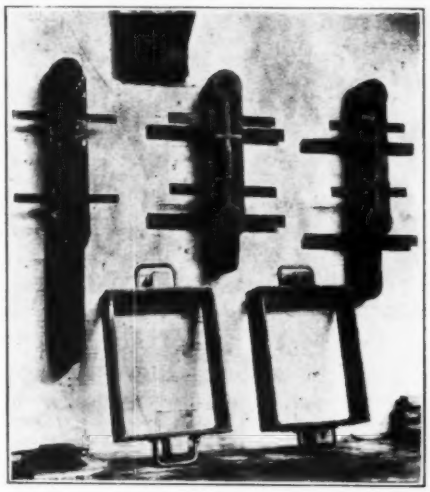


Fig. 9 shows a Method of Jig-Drilling from Holes for Moulding Boxes Ranging from 11- to 30-in. Centres.

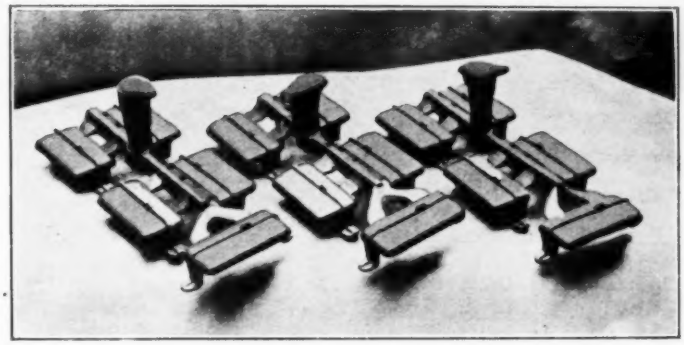


Fig. 11 shows a Case where the Risers and Runners are Heavier than the actual Castings, of which 15 weigh 2 lbs. 12½ ozs., whilst the Runners are 2 lbs. 15½ ozs.

much attention cannot be bestowed, as every single job requires its own consideration whether small or large. Fig. 5 shows a case where too much runner gate has been provided—result, dirty castings—and at its side a second casting corrected to proper proportions, enabling the down gate to be filled up with ample running space, so that any scum or loose sand may rise to top. Fig. 6 is interesting as showing two sprays of defective castings due to insufficient metal in the risers, the good ones with deep risers having been knocked off. This condition is shown corrected in Fig. 7. Fig. 8 shows the moulds and core box for machine production, whilst Fig. 9 shows a method of jig-drilling for moulding-box locating pins which are loose bushes in hardened steel, and have wrought-iron stays. The arrangement covers 11, 12, 14, 16, 20 and 30 in. centres.

Fig. 10 shows four half-moulds 12 in. by 8 in., and how they are fastened together to make a standard-sized mould. Fig. 11 illustrates a full mould consisting of three sprays and 15 castings, weighing 2 lbs. 12½ ozs. The gates and runners weigh 2 lbs. 15½ ozs., a total weight of 5¾ lbs., the sprues and runners being actually 7 per cent. more than the castings.

Fig. 12 A, B, C clearly shows how a complicated pattern can be made into a simplified moulding operation. It is an interesting innovation and is worth detailed consideration. It will be seen that the moulding operation is simplified and an apparently intricate job resolves itself into quite an ordinary proposition under modern conditions. The sand used is red and black in approximately equal proportions mixed with resin and dried at about 200 deg. C.

Sea sand is often unsuitable in foundries where casting is carried out only once daily, and consequently moulds are cored, closed and stand over until the latter part of the day. The moisture absorbed by sea-sand cores from the green-sand moulds, causes sagging and distortion. Plain finger cores for hubs quite often sag seriously. Where extra strength is required for threads, a little more red sand can advantageously be added. Core stocks are made in iron, faced and threaded according to size, due allowance being provided for contraction, and the finished product ready for use comes straight from the foundry, after cleaning and fettling. If one cares to run over the threads with a chaser to give the appearance of a machined product, and secure a higher selling price, so much the better.

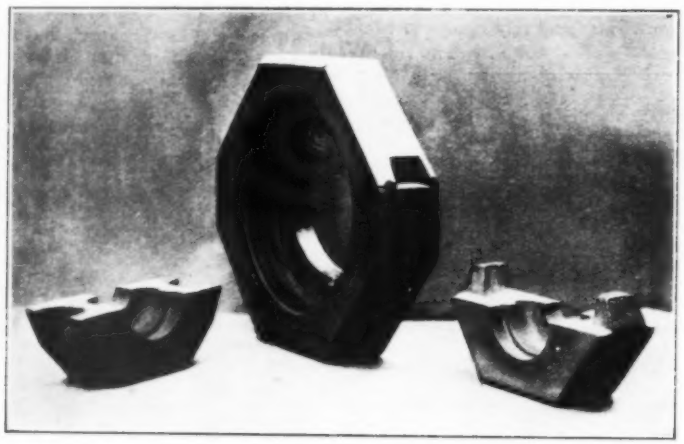


Fig. 12A showing the Core Stocks. Note the Threads.

Fig. 12B shows the Cores Carrying the Threads.

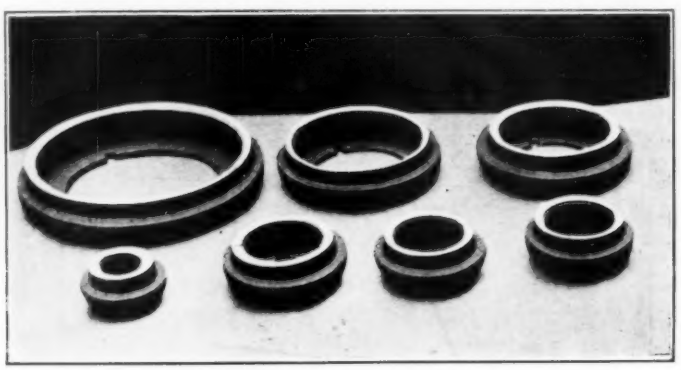


Fig. 12C.—The Finished Castings.

Iron and Steel Institute.—Shortly after the Annual Meeting of the Iron and Steel Institute, to be held in May, additional meetings will be held in Middlesbrough, Birmingham, Sheffield and South Wales.

Impact Tests for Cast Iron.

At the meeting of Subcommittee XV on Impact Testing of the American Society for Testing Materials Committee A-3 on Cast Iron, in Cleveland on March 7, a report of the progress on the investigation of impact testing of cast iron was given. The subcommittee has been engaged for the past two years in this investigation of cast-iron impact testing. Twenty-four sets of test-bars have been secured from various co-operating foundries in the United States. These bars cover practically all the commercial classes of cast iron, and have been used for static tests and various impact tests in this investigation. Several thousand tests have been made and the data are very nearly complete. The expectation is that final results will be obtained within the next two months, at which time a report will be drafted to be submitted to the Society. The subcommittee has performed a vast amount of work, which represents probably the most comprehensive programme on physical properties of cast iron ever attempted in the United States.

The Committee has realised the need for classification of types of cast iron and the development of specifications for these various classes. During the past year the Subcommittee on General Castings was organised to carry on the work. It has suggested a set of classifications which have been approved by the main committee, but additional data are required before specifications can be developed. This will be furnished by another subcommittee on Correlation of Test-Bar and Casting through the co-operation of the Gray Iron Institute, which has offered data that it has accummulated. This should be of considerable value in the development of specifications.

The Subcommittee on Cast-Iron Culvert Pipe has developed tentative specifications for cast-iron culvert pipe—the specifications having been approved by Committee A-3; they will be presented to the Society for action.

Bethlehem Steel Corporation.—The net income of the Bethlehem Steel Corporation and its subsidiary companies for 1931 was $115,745, as compared with $23,843,406 for the preceding year, equivalent to $.12 per share of preferred stock for 1931, as compared with $5.26 per share of common stock for 1930. The value of shipments and deliveries by subsidiary companies, as represented by gross sales and earnings, was $186,541,195, as compared with $258,979,253, while the value of orders booked aggregated $159,629,477, against $241,344,965. The unfilled orders on December 31, 1931, amounted to $41,514,877, as compared with $68,426,595 on December 31, 1930. Full dividends were paid on the preferred stock during the year, and the common shares received $4.50, against $6.00 per share.

United States Steel Corporation.—The annual report of the United States Steel Corporation shows an operating loss of $6,303,000 (£1,261,000 at par) for 1931, as compared with an operating profit of $93,520,000 (£18,704,000) for 1930. Adding special income amounting to $19,341,000 (against $10,901,000) leaves a balance of $13,038,000 (against $104,421,000) for preferred dividends requiring $25,219,000 (same). Deducting common stock dividends, the final deficit amounts to $49,165,000 (£9,833,000), as against a final surplus of $18,836,000 (£3,767,000) in 1930. Output of finished steel products in 1931 was 7,676,000 tons, against 11,609,265 tons in 1930.

The Testing of Castings.

On March 10, the second day of the spring meeting of the Institute of Metals in London, there was an interesting discussion on the testing of castings, opened by Dr. W. Rosenhain, F.R.S., whose address was printed in a recent issue of The Foundry Trade Journal.

The President of the Institute (Sir Henry Fowler) was in the chair.

Low Scrap Returns.

Mr. J. B. Hoblyn, who first, in his usual jocular manner, expressed his appreciation of the fact that Dr. Rosenhain had at last presented a Paper which he (Mr. Hoblyn) could understand, emphasised the importance of the time factor in the testing of castings. As an example, he said that if a motor-car manufacturer wanted 200 back-axle casings to go through the firm in one week, he would not be justified in applying the principle of Archimedes, and in spending the time required for a test involving the weighing of the materials, perhaps in air and in water. Mr. Hoblyn was beginning to think that the very best tests for castings were those carried out on the works when the men were operating upon them; the test on the casting was the real thing, and he had no use for the sand-cast and chill-cast test-bars. If one machined a malleable-iron or cast-iron test-bar and found it to be full of blow-holes, what could one do?

Mr. Hoblyn then went on to exhibit photographs of a number of castings containing all kinds of blow-holes and flaws, to emphasise the point that visual examination of castings in inspection departments was better than any examination of sand-cast and chill-cast bars. (Some of the specimens illustrated were so bad that Dr. Rosenhain was heard to suggest, *sotto voce*, to Mr. Hoblyn, that he might with advantage obtain castings from a better founder, and might also ensure that the castings were better designed.) Mr. Hoblyn caused a good deal of amusement when he referred to X-ray testing, and expressed the opinion that if castings were tested in this manner in a foundry, no castings would ever go out. Thank goodness, however, in these days of mass production, the founder was realising that he must do his work better. In his own firm, the flywheel scrap from the foundries was less than 1 per cent., and the general scrap from the foundries was less than 5 per cent., which was equal to anything that could be done in America. That indicated that the founder and the manufacturer were joining hands, each conscious of their own dignity and ready to yield to the other his due share of honour.

Cast-on Test-Pieces.

Dr. Georg Sachs, whilst agreeing that in *general* foundry practice the separately-cast test-pieces should be used for acceptance testing, pointed out that where high demands on the quality of castings were imposed one could and did go somewhat farther, and sought to test samples taken from the casting itself. It was true that the cast-on test-piece, which was joined to the casting by one or two thin runners, had little advantage over the separately-cast bar; it could be almost as strong as the latter and could be surreptitiously "doctored." But projections on a suitable part of the casting, attached for their whole length and afterwards sawn off, whose position on the casting, dimensions and method of runner (position in relation to the gate, chills, etc.), were definitely fixed, gave average values and limits of variation which agreed approximately with those of the casting. These projections would be placed as near as possible to the most highly-stressed part of the casting. This test was certainly somewhat more expensive, and its evaluation demanded more consideration than the separately-cast test-piece; nor could it be directly related to a number of castings in the same alloy without further consideration, but it must be adjusted by the mean value derived by experience and determined for the particular casting or similar ones. Also, one must either cast on a single casting a number of such projections or content oneself with the average of a number of castings as a basis for judging the whole batch. The acquiring of the data for such an acceptance test was a preliminary task for the foundry and the user to accomplish in co-operation. Instead of a definite specification there would be obtained a signpost. This work would, however, prove of importance beyond the acceptance of single consignments and would serve to effect a real improvement in the quality of the castings. The Junkers Motor Works, which made a point of specially good casting quality, had regularly availed itself of this practice for some time.

Properties of Actual Castings.

More important than any acceptance test, however, was exact knowledge of the properties of the particular casting alloy. From the very little reliable information existing in literature concerning the distribution of strength in castings, one found that the maximum and minimum strength value with all sorts of different casting alloys showed a variation of the order of from 1 : 1.5 to 1 : 3. These differences were not distributed regularly, but almost the same variations were found in immediately-adjacent partings of a casting. Even in tensile test-bars, cast under only slightly-varying conditions, but without rigid standardisation, variation up to 1 : 2 was observed, although by more careful work appreciably narrower limits could generally be preserved. It could not be over-emphasised, therefore, that, for cast even more than for wrought metal, a single test-piece was useless as evidence. Rigid standardisation of casting conditions for the test would not alter this fundamentally. The tensile test was very sensitive to structural defects, such as draws, blow-holes, fissures, slag inclusions, etc., and it appeared that, especially in a test-piece cut from the casting, one disclosed the existence of these defects rather than the properties of the metal itself. In this connection, Dr. Sachs referred to the results of a series of tensile tests on bronzes. In the graph of strength as a function of elongation the values found for different samples of the same alloy arranged themselves well about a line which corresponded to the load-extension curve. The true quality of the material, which was expressed by the course of the load-extension curve, was practically the same for all samples. According to the extent to which the cross-section of the test-piece was weakened by structural defects, the load-extension curve broke earlier or later. An evaluation of testing results on cast bars on this basis, he said, made it possible to acquire an insight into the extent to which variations in strength were due on the one hand to defects and on the other to the true properties of the material.

Minute Fissures More Detrimental than a Blowhole.

Radiographic examination of slices from large castings rendered extremely small pinholes and fissures visible. Castings which appeared dense from the observation of the surface were often more full of holes than others on whose surfaces pores were distinctly noticeable. It must be borne in mind that the minute fissure-like pores, which could not be seen on the polished surface, had much more effect in reducing the mechanical properties than had the larger rounded ones. He had occasionally carried out an investigation, not on tensile test-bars, but on special samples approximately similar geometrically to the castings. The influence of chemical composition, casting procedure and heat-treatment was very similar in the model and in the actual casting. The acceptance test could be carried out on a laboratory scale with a model casting, and the results translated, with good agreement, to actual practice.

Pressure Testing.

Mr. A. H. Mundey said he believed that most manufacturers did not desire to have test-bars fastened on to their castings, but that was insisted upon by nine inspectors out of ten, and he was afraid that some time would elapse before they were converted. Discussing the two classes of test, *i.e.*, investigatory and the acceptance test, he urged that the investigatory tests must be carried out in the early stages so that the designer and the manufacturer would know all about the strengths and qualities of the material throughout the casting; then the acceptance test must be made on the material itself as material and not as part of the casting. He had obtained altogether different results of tests made on various parts of large castings; thus, the results of the tests were not truly indicative of the quality or the properties of the material as material. He urged the co-operation between designer and metallurgist. One of the greatest troubles in the foundry was not the production of inherently bad material, but of unsound material. A very large number of the most important castings to be handled had to be subjected to air- or water-pressure, or perhaps both, and hydro-pneumatic pressure was probably the most severe that was imposed on castings. There was a certain amount of danger involved in the testing of unsound castings, and he recalled an occasion when one of his colleagues at Woolwich had been killed in the course of some tests on castings due to their unsoundness. The method of weighing castings was used in connection with certain die-castings as they came off the machines, and this method was found to be an extraordinarily useful one. Certain other castings were tested by means of high-pressure air under warm water, the bubbles being observed. Finally, he pointed out that serious trouble might occur as the result of castings pocketing sand or core sand, and he referred to a gun mounting which had broken down due to that cause.

X-Ray Testing.

Dr. G. Shearer amplified Dr. Rosenhain's remarks as to the possibilities of applying X-ray testing, by exhibiting a number of X-ray photographs. His slides included the spectrum of a commercial cast steel before and after annealing, which indicated the great difference in the steels under the two conditions. It was seen in the steel before annealing that there were radial streaks which were usually ascribed to the presence of strain in the crystals. It was possible, he added, that the strain hypothesis was not the correct one, but on the whole the evidence was in its favour. He gave other examples and explained the features which indicated lack of homogeneity and other defects, and indicated the means by which one could obtain from the illustrations some quantitative estimate of the amount of strain present in a specimen.

Engineer Rear-Admiral Mark Rundle, D.S.O. (R.N. retired), speaking from an inspector's point of view, said that the practice of using separately-cast test-bars might introduce difficulties in cases where a large number of castings had to be dealt with, because, unless an inspector was sure of the honesty of the foundrymen, it would be difficult to assure himself that particular test-bars related to particular castings; the inspector would have to be present when the castings were turned out. He emphasised the importance of applying to a casting, whenever possible, a test under conditions of a similar nature to those it would have to meet in practice.

Machined Test-Pieces.

Mr. R. H. Harry Stanger (President, Institution of Structural Engineers) drew attention to the fact that tests on cast iron were carried out, as a rule, on specimens as cast, and he had often wondered why the specimens should not be tested also in the machined condition, inasmuch as the cast iron had to be machined before use. In the case of the transverse test, for example, there was a difference in the deflection, and he pointed out that non-ferrous specimens were machined as a rule. He was concerned with these matters from the point of view of specification tests, and there were times when he had found that if one was fairly sure of the material, one could afford to neglect the absolute letter of the specification. As an inspector, he had always found that the foundrymen were honest; that being the case, he personally preferred a separately-cast specimen to one cast on. In this connection he recalled an instance in which specimens were cast on to the castings at a foundry having a worldwide reputation for producing good material. The materials had not been tested for some time, because the authorities knew they were good, but when a new inspector had been engaged, and who did not know the producers, he had tested a number of samples and had found that they had failed on extension. This was so extraordinary that he (Mr. Stanger) had suggested smashing up one of the castings, and testing the metal therefrom, and it was found to be absolutely satisfactory. It was, therefore, decided, having regard to the reputation of the firm, to accept the castings. Later the explanation for the failure of the specimens became obvious when one of the men in the foundry was seen straightening a test-piece on an anvil. Each test-piece was cast on the body of the casting, and was not sawn off completely, but only partly, and then flogged off and straightened on an anvil. He did not think they could be expected to stand up to that treatment. Finally, with regard to the inspection of steel castings, he said it was his practice to have them suspended in air and hammered. On one occasion an inspector had rejected a large number of rather heavy castings. When slung on two slings, they had sounded dull, as though cracked, but when they were slung from one, it was found that they were absolutely sound. Those castings were still in use.

Mr. A. J. Murphy suggested that, although few at that meeting would dispute Dr. Rosenhain's view in favour of separately-cast test-bars, there was still a vague feeling prevailing in wider circles that the cast-on bar did give an indication of the quality of the casting as distinct from the quality of the metal of which it was made. He did not think the cast-on bar was advocated simply because it showed that the metal tested was exactly the same as that which had gone into the main casting. Another aspect of the question was that it was often not possible so to locate a cast-on bar as to ensure that the metal there was adequately fed during solidification. Further, there was sometimes a real danger that the test-bar cavity, which was never designed for in the original design of casting, might act as a dirt trap during the pouring operation. Mr. Murphy also urged that we should have to face the problem of controlling the amount of gas in light alloys. It was quite well established that there were certain chill-castings—complicated die-castings—that could not be made satisfactorily with material which was entirely free from gas. He did not mean that one was entitled to use gassy metal simply because it filled a mould, irrespective of what the inside of the metal was like, but an aluminium alloy containing gas could give a perfectly satisfactory chill-casting, although that same material, if tested in a loose sand bar, would be rejected every time.

Mr. R. B. Deeley, who supported Dr. Rosenhain's contention with regard to the separately-cast sand-test bar, said that in the case of aluminium-silicon alloys it was essential from the specification point of view to have a sand-cast bar. In these alloys a certain amount of modification was obtained by chilling, and the chill-cast test-bar would give high results, whereas the casting which it represented might be extremely poor. It might be said that the cast-on test-bar was particularly applicable in this case; but assuming a good-quality modified aluminium-silicon alloy, the cast-on test-piece was obviously no criterion of the strength of the various parts of the casting. He added, however, that in his experience the properties of a casting in aluminium-silicon alloy varied within a very much smaller range than in castings of other aluminium alloys. Finally, he emphasised that whilst he hoped that as a result of the discussion better means of testing castings would be evolved, it was important that they should not add considerably to the costs.

Mr. A. Wragg did not think there was very much difference between a cast-on and a separately-cast test-bar in castings of, say, gunmetal and manganese bronze. There were certain objections to a cast-on test-bar in regard to its location, height of feeder, method of running, chilling and so on; on the other hand there were different methods of running test-bars, and one had to consider how they should be cast. One might be able to prove the material by using standardised separately-cast test-bars, but the results of the test on the casting might be different from those obtained on the standard test-bars as the result of differences in the technique of casting at the different foundries. One serious objection to separately-cast test-bars, from the production standpoint, was that of ensuring that a particular test-bar was cast from the same metal as a particular casting. Again, if one had a ladle full of metal and a quantity of small castings had to be produced from it, should the test-piece be cast at the beginning of the pouring operation, when the metal was hot, or after the last casting had been poured? Density tests could be applied to small castings, but only to those with simple shapes. As to the Brinell test, big differences were experienced according to whether the castings were tested on the skin or whether the skin was taken off.

Dye-Penetration Tests.

Dr. D. H. Ingall dealt with one or two unsoundness tests, and particularly porosity tests, which had not been mentioned by Dr. Rosenhain. The first was the dye-penetration test, which he believed was employed to a certain extent in America. Petrol containing a dye, such as methylene blue, was painted or sprayed on the side of the casting, of which the section was not too thick, and the other side of the casting was examined for penetration of the dyed petrol. Another test was the dye-evaporation test, in which alcohol coloured with picric acid or some other bright dye was placed on the side of the casting; this surface was wiped more or less dry, the casting was put into a warm place, and subsequently examined for exudation of the dye. Pressure tests, in which the penetration of water under pressure was measured, were also described.

Mr. George Mortimer, commenting on Mr. Hoblyn's examples of bad castings, said it was important to ensure getting the metal into the casting, and that the metal going into the mould was of high quality all the time. That was why we in this country tended to use a bar by which we could test the quality of the metal rather than the casting itself. After emphasising the need for international agreement on various matters, including the problem of test-bars, he said he was emphatically in favour of the use of separately-cast bars. It was a great mistake to assume that identity was necessarily accomplished by an integral bar. It was quite possible —although he did not say that it would be done —to weld a piece of heat-treated "Y" alloy on to an aluminium casting. However, talk of that sort was bad psychology; it was better to trust the founder to turn out the best job he could. A stringent test which would enable one to detect porous areas, or a sink or a draw, was to sand-blast a casting all over. The test in which a dye such as methylene blue was used to test porosity was still more stringent; if the casting were porous, the dye would go through it—and one could not remove the dye. Almost any expense would be justified, he said, to provide a means whereby it was possible to ensure a high degree of soundness. Mr. Mortimer associated himself with Dr. Rosenhain's remarks concerning X-ray examination, and added that the same remarks applied to density tests. It was not only necessary to know when a casting was unsound, but it was also necessary to know the extent, the location and the type of unsoundness before the trouble could be rectified; neither X-ray nor density measurements gave a real insight into those matters.

Ductility Testing.

Mr. R. Genders said that to a large extent there was agreement among those best qualified to speak as to the best means of ensuring the serviceability of castings, and these methods, though limited, should serve temporarily. With regard to the testing of ductility, he said the measurement of small elongations on tensile test-pieces was admittedly unsatisfactory, but it was questionable whether the information to be gained from bend tests would be much more valuable. With relatively brittle materials, the total deflection of the bend test-piece before fracture was small and represented the sum of the elastic deflection, calculated to be of the order of 0.2 in. for a bar of aluminium 12 in. long and 0.5 in. square, and the small amount of permanent deformation undergone between the elastic limit and fracture. This permanent deformation, representing the measure of ductility in the test, was mainly localised, owing to the concentration of stress at the point of flexure, and was comparable with the local elongation which occurred in the immediate region of a tensile fracture. It was probable that the general elongation measured in the tensile test as a part of the total was not reflected to the same extent in the bend test. Thus, the bend test, although apparently more sensitive, gave a measure which included elastic deformation and neglected a small amount of ductility which would be included in the tensile test. The bend test was also affected by local defects in the material, similarly to the tensile test. Therefore, the addition of the bend test to those already in use should only be made when full investigation had provided proof of its value. On the other hand, the bend test could be made on the material as cast, without machining, and also difficulties caused by test-pieces fracturing at inconvenient positions were avoided.

Co-operative X-Ray Testing.

With regard to the general problem, it seemed inevitable that any methods which might be found capable of determining the serviceability of castings would involve some elaboration of testing. It appeared essential that in any perfected system of reception testing each particular design of casting must to some extent be treated individually, apart from the mechanical tests on separately-cast bars which applied generally to govern the quality of the liquid metal. Density determinations were practicable with comparatively large masses, and measured with sufficient accuracy the total volume of any internal cavities. For information as to the number and disposition of the cavities there was no more certain method than the use of X-rays—he had in mind the shadow method, not the spectroscopic. It should be practicable, for each design of casting required in numbers, to take trial castings for density and X-ray tests, and to

arrive, without undue expense, at a pattern, complete with runners, etc., that would produce the best result under certain casting conditions, which would ultimately be specified. It might not be possible or economical to instal large numbers of testing equipments, but with properly organised co-operation in the different branches of the foundry industry such a plan for the improvement of the product would appear reasonable.

Perhaps one of the most fruitful causes of defective castings was the tendency to save scrap and labour in trimming at the expense of the runners and risers. A firm of hydraulic engineers, having experienced considerable trouble with steel castings some years ago, had found that the most successful founder used a weight of metal not less than twice that of the finished castings. It would be undesirable, of course, to specify any such limits of working, and it might have been possible, by improved methods, to reduce considerably the weight of metal used. Examples such as this, however, showed how necessary it was that the founder should possess more definite information regarding his castings and the effects of changes in procedure. For this reason Mr. Genders advocated the wider adoption of density determination and X-ray examination, not as ordinary reception tests, but as a means of arriving at the best conditions. With the general adoption of this method, the present mechanical tests could be relied upon for the final reception testing.

Four Basic Tests.

Mr. H. W. G. Hignett said that when a standard test-bar was proposed it was tacitly assumed that the tensile test gave sufficient data at least for a preliminary acceptance test of quality. If this were the case, one could obtain for a given alloy four sets of quality figures which were of interest to any one particular foundry:—(1) The maximum figure which could be obtained for the alloy when it was cast under laboratory conditions, represented by a constant; (2) the maximum figure which this particular foundry could obtain, using its ordinary equipment (in some cases this would be obtained with a chill-cast test-bar, and in others with a sand-cast test-bar); (3) the figure obtained on such a standard test-piece as that suggested by Dr. Rosenhain, and (4) a whole range of figures to be found in the casting itself. This last would vary very considerably with differences in foundry practice—melting conditions; number, size and positions of runners, risers and chills; nature of moulding sand; method of ramming, and many other details—which were adjusted by the skilful foundryman to produce the best results. Two different foundries might use very different methods and produce castings of equal quality—there were many permutations and combinations of these foundry details which gave practically the same results—so that for efficient foundries the average quality of a given casting in a given alloy should approximate to a constant.

In the standard sand-cast test-bar, however, where certain of these details were definitely fixed, there was no opportunity for adjustment, although this might be rendered advisable by variation in factors which it would be impossible or impracticable to standardise. For example, the heads and runners which gave the best results with a gunmetal melted in a coke-fired furnace would not do so when an oil-fired furnace was employed. Although it might not be possible to remove the difference completely, it was certainly possible to reduce it very considerably and raise the lower value by an alteration in casting procedure. Thus, it seemed that the test-bar whose casting conditions were left to the discretion of the founder, so that he should obtain the best possible figure for the particular alloy, would give results which were more constant and, therefore, more suitable for correlation with the properties of the casting. In some cases this bar would be chill-cast and in some cases sand-cast, vertical or horizontal, with or without risers.

The objection raised to this type of test-piece was that the figure it gave differed very much from the figures obtained on pieces cut out of the casting. This objection was hardly logical when it was admitted (and obvious) that very careful correlation was necessary, even with the sand-cast bar.

The discrepancy between the test-bar giving maximum figures and the casting was due to defects in the latter, concerning the exact causes of which there was a lack of fundamental knowledge. Mr. Hignett suggested tentatively that it was preferable to eliminate the discrepancy by eliminating the defects rather than by using a standard test-bar which contained them.

The President said the engineers wanted to know the strength of a casting, they would like to break up and test one casting and consider the design in the light of what they had learned from the tests made on it. That was the ideal. Then he would like a carefully-considered cast-on piece and then, if possible, to make another break-up test of the casting with the test-piece still attached, and if necessary reconsider where it should be put. That could be done, and was done in certain cases where many repetition castings were required.

Mr. Graifebatch (speaking on behalf of Dr. Pullen, of Woolwich) exhibited some illustrations to indicate the value of X-ray examination, as applied at Woolwich, and said they did produce sound castings there. Discussing a method of inspection by means of radium, he exhibited an X-ray photograph and a radium photograph of a specimen. The X-ray photograph showed a flaw quite distinctly; in the radiograph there was also an indication of the flaw, but not so definite, but when radium was used there was a penetration of the thick portion of the metal, which was not attained with X-rays. In the case of X-rays the exposure was 12 hrs., but in the other case only 2 min.

Dr. Rosenhain, in a brief reply to the discussion, said he had deliberately put forward questions with regard to which he knew there were considerable differences of opinion—some well informed but others not quite so well informed. With regard to Mr. Hoblyn's illustrations of specimens from the scrap heap, he pointed out that the subject of the discussion was the testing of castings and not the inspection of them—and what was at fault more than anything else in the cases mentioned was the inspection. He was astonished to hear that Mr. Hoblyn had no use for a testing machine. He was also surprised that Mr. Hoblyn had succeeded in understanding this Paper, if he could not understand previous Papers; but he (Dr. Rosenhain) was not sure that Mr. Hoblyn had understood it.

The account given by Dr. Sachs of the care taken in German foundries to secure good castings was very much on all fours with what the President had suggested. Dr. Rosenhain differed from the President in that he would like to see correlation, not from the cast-on piece, but from the infinitely more acceptable separately-cast test-piece.

The President: From your point of view?

Dr. Rosenhain: From every point of view.

Continuing, Dr. Rosenhain said that perhaps the whole point had been confused during the discussion by mixing up foundry technique and inspection with the question of testing. The only speaker with whom he cordially disagreed was Mr. Hignett, who seemed to have misconceived the whole question at issue. When Mr. Hignett suggested that the founder should be allowed to adjust his test-bar so as to get the best results out of the metal, he was suggesting that we should allow a man who made inferior metal to get sufficiently good tests out of it by any device he could use. That was how the suggestion would be interpreted in practice. We must standardise things; if A could make metal with that standard material, B could do also, or he was at fault, provided that the standardisation was arrived at as a result of sufficiently careful investigation. The mould to which he (Dr. Rosenhain) had referred had been standardised for use with light alloys only, but whether it was suitable for bronzes and brasses he did not yet know, because it had not been tested sufficiently.

In reply to Mr. Genders' criticism of the suggested use of the bend test, he did not think Mr. Genders was right, because, although there was something in the fact that the elastic deformation of a light alloy beam would be greater than that of a cast-iron beam, yet he believed that the permanent deflection would still be very much easier to measure than the small extension on a tensile test-piece. One thing which had arisen out of Mr. Genders' remarks, and which probably it would be possible to incorporate when we came to carry out the test after further investigation, was to test, not by the application of a single load, but by the application of such loads as would give a uniform bending moment over the part of the beam under test, and in that way obtain the elongation—the deflection really—over the greater length of the test-piece than would be the case if a single bend were applied. It meant merely a double ram on the bending press instead of a single one, and he believed that that would overcome the difficulty if, in fact, it proved to be as serious as Mr. Genders had suggested.

The "Qualcast" Annual Dinner.

The 12th Annual Dinner of Messrs. Qualcast, Limited, was held on March 19 in the Assembly Rooms, Derby. About 350 people dined, under the Presidency of Mr. J. E. V. Jobson, the chairman and managing director of Qualcast. He was supported at the high table by his colleagues on the directorate, Mr. C. W. Bigg, Mr. O. J. Jackson and Mr. F. S. Richardson, and amongst the guests prominent in the foundry industry were Mr. John Cameron, J.P. (Past-President of the Institute of British Foundrymen), Mr. V. C. Faulkner (also a Past-President and Editor of The Foundry Trade Journal), Mr. D. Howard Wood (President, Foundry Supplies and Equipment Association), Mr. H. F. Coggan (August Muffle Furnaces), Mr. T. L. Hale (Thos. L. Hale, of Tipton).

A pleasing feature of the evening was the presentation of about a dozen clocks to employees who have been associated with the firm for 10 years.

In a short address Mr. Jobson stated that the past year had seen several records broken. They had melted more metal, paid a larger wage bill, and secured a bigger profit than ever previously in the history of the company. The works now occupied an area of 3 acres, and he hoped that before many years passed the whole of the 7 acres available to them would be covered by buildings. The business in Australia had now turned the corner, and was beginning to contribute something to the profit account. He ascribed the success attained to the wonderful team spirit exhibited from top to bottom of the concern. He enunciated very strongly that the scope of a works committee was confined to internal matters affecting the welfare of the firm and its employees, and was divorced completely from trade union affairs.

The function was thoroughly enjoyed by everyone participating.

American Society of Tool Engineering.—This Society was formed at a meeting in Detroit on March 3 to advance the knowledge of tool engineering. Headquarters have been established at 8203, Woodward Avenue, in that city.—"Iron Age."

John Surtees Memorial.

PRESENTATION OF MEDALS AND PRIZES AT SCOTTISH BRANCH.

This competition, founded by the late William Mayer, a former President of the Institute of British Foundrymen, to commemorate the introduction of dry-sand moulding by John Surtees, is held alternately in Newcastle and Scotland. The competition this year was held in Scotland.

In the Senior Grade the candidates were asked to write an essay on one of four stated subjects:—(1) The production and applications of alloy cast irons or alloy-steel castings; (2) the preparation and handling of sands by mechanical means in other than mass-production foundries; (3) the use of pulverised fuel in the foundry; and (4) modern melting equipment for foundry use.

Five candidates entered for the Senior Grade, and the Governors, on the recommendation of the examiner, made the following awards:—

Gold Medal and First Prize, Robert McNab.

Second Prize, W. Mortimer.

In the Junior Grade the candidates were asked to prepare a detailed account of some operation or process, such as the candidate might be asked to perform in the course of ordinary work. This part of the examination was designed to test the intelligence and resourcefulness of the candidates, as they were asked to *collect* the necessary information from any available source and not to regard the exercise as a test of memory.

The second part of the competition was an ordinary examination paper consisting of nine questions, four of which had to be answered by the candidates. There were 25 candidates, and, on the recommendation of the examiner, the Governors made the following awards:—

Silver Medal and First Prize.—Robert P. Clark (Jones & Campbell, Torwood Foundry, Larbert).

Second Prize.—James Liddell (Broomside Foundry, Bonnybridge).

Third Prize.—Walter S. McCarthy (Mavor & Coulson, Glasgow).

Consolation Prizes.—David Slater (Fairfield Shipbuilding & Engineering Company, Limited, Glasgow); Isaac Wilson (Mirrlees Watson Company, Glasgow); William Cassidy (Hardie & Gordon, Dumbarton).

Presentation of Prizes.

The prizes were presented at a meeting of the Scottish Branch in the Royal Technical College, Glasgow, on March 19 by Col. A. D. McInnes Shaw, D.S.O., D.L., J.P.

Mr. N. McManus, M.B.E. (Branch-President), who presided, said that they had arrived at a very pleasant part of the programme, the presentation of the Institute Diploma, which had been awarded to Mr. Robert Liddle for the Paper which he read to them last session on the casting of large bronze tube plates. He thought that it might be as well if he refreshed their minds as to the conditions governing the award of the diploma of the Institute. It was founded with the object of stimulating the interest of members in the preparation of Papers having an interest to foundrymen in general, more particularly on the practical or scientific side of foundry work, and a high standard of excellence is demanded before an award of the diploma is granted by the Literary Committee of the Institute.

The Council considered that the Paper which Mr. Liddle read fulfilled the conditions, and made a recommendation to the General Council to that effect. It was gratifying to know that that opinion had been confirmed by the committee at headquarters and the diploma awarded. Regarding the Surtees competitions, these were held bi-annually in Glasgow and Newcastle, the Senior Grade being open to members and associate members of the Branch of at least 12 months' standing, and in the Junior Grade all apprentices in the foundry trade were eligible, provided they intended to continue in the trade as journeymen, officials or principals. He had pleasure in introducing Col. McInnes Shaw and asking him to make the presentations.

Col. McInnes Shaw, D.S.O., D.L., J.P., said it afforded him great pleasure to be present, and he considered it a great honour to have been asked to present the diplomas and prizes to the successful candidates in the competitions. As a humble foundryman, he confessed to being somewhat ashamed to know that these diplomas and prizes were available for award and that he had taken so little interest in them, but the work which was being done by the Institute of British Foundrymen was not unknown to him, and he could assure them that their work was fully appreciated by the leaders of the industry. He hoped that he would be able to take a more active part in the future.

It was a matter of great satisfaction to him to know that, so close to his death, his father's name was associated with the prize which had been founded to commemorate the coming of age of the Branch, and of the interest which his father had in its work for the industry and also the active association of it with the Corporation. He knew quite well that the chief objective of the meeting was to discuss certain important matters appertaining to foundry work and would not detain them longer, but he wished to say that both he and his mother had been greatly touched by the kindly references which they had made to his father's efforts on behalf of the industry and the city. He thanked them for the kindly reference to his father in the report which had just been read. Col. Shaw then made the presentations and spoke a few words of congratulation and encouragement to each recipient.

Vote of Thanks.

Mr. A. Campion said that they were much indebted to Col. Shaw for having come and made the presentations; they were delighted that he was following in his father's footsteps and taking an interest in the Scottish Branch. They had been fortunate in obtaining the services of prominent personages to distribute the prizes on each occasion that the Surtees competition had been held in Scotland, and in that way a good deal of publicity was obtained and usually an accession of new members resulted. They wished to secure a greater amount of support from the employers and their assistance in encouraging the young men to enter for these competitions as a means of making themselves more fitted to carry on the industry and to promote its advancement when the time came for the present generation to drop out. It was necessary for the young men to realise that they would be expected to do something a little in advance of the present requirements; a son should always expect to do a little better than his father. Foundrymen sometimes were heard to say that a certain thing had been good enough for his father or his grandfather and should be good enough for him; that, however, was not the way to progress—it had to be remembered that those fathers and grandfathers lived in different times and had probably worked very hard to develop a foundry or a process to the stage at which they left it, they had been progressive men of their time. The real question was, would those people have done things the same way to-day as they did then? He thought they would not, and would be disappointed to find that their sons had stood still and not progressed. Col. Shaw had gone a little in advance of his father as he was the nominated member of a subscribing firm, and he hoped that they might have the pleasure of the Colonel's company at many of their meetings. They were greatly indebted to him for presenting the prizes that day, and he asked them to express their thanks in no uncertain manner.

Col. Shaw said that he was much obliged for the vote of thanks. There were certainly a number of other events that day, but he thought one was much better employed in getting into closer touch with those engaged in the foundry trade. The more they pulled together the better it would be for everybody. There was at one time an idea that principals and foremen were apart from the workers, but happily that does not exist to-day, and it is realised that everyone engaged in the trade must pull together. The more they could get together and discuss the various aspects of the work the better for the trade in every respect. He thanked them for the kind reception they had given him, it had been a real pleasure to him to distribute the prizes, and he hoped, as had been suggested, to be in closer touch with them in the future.

Improvement of High-Alloy Austenitic Nickel-Chrome Steel by Carbide Precipitation Hardening.

In a communication from the Research Laboratory of the Isolation A.-G., Mannheim, published in "Archiv für das Eisenhüttenwesen" for December, 1931, Dr.-Ing. Erich Greulich described an investigation of the effect of carbide separation on the properties of austenitic nickel-chrome steels. Six steels were examined, with carbon contents varying from 0.22 to 0.51 per cent. It was established that an improvement resulted from quenching in water from annealing temperatures above 900 deg. C. when followed by tempering within the carbide-precipitation range (650 to 750 deg. C.), but that the improvement was only substantial when the steels were quenched from 1,150 deg. C. or over. The yield point was raised to 190 per cent. and the ultimate strength to 120 per cent.; on the other hand, the impact value and ultimate extension were reduced by 50 per cent. While at 650 deg. C. it was necessary to temper for 33 hrs.: at higher temperatures the time required was considerably less, but at the same time the improvement effected was also considerably less. The speed of cooling had to be fairly high, since specimens cooled in air showed only slight improvement, while none at all was obtained when cooling was carried out in the furnace. The carbon content of the steels naturally had a fairly large influence: at 0.2 per cent. the improvement was considerable, reaching a maximum with 0.3 per cent. and falling away slowly above 0.4 per cent.

The effect on the properties at elevated temperatures was particularly noticeable above 450 to 500 deg. C., and was evidenced by a considerable increase in the yield point and ultimate strength, from which a displacement of the creep limit to higher temperatures and a reduction of the speed of creep may be inferred. In one instance the tests were carried out on a steel of the following composition: C, 0.41; Si, 0.12; Mn, 1.84; P, 0.022; S, 0.020; Cr, 9.60, and Ni, 36.05 per cent. This was heated at 1,200 deg. C. for an hour in a protective gas and then quenched in water, followed by tempering at 700 deg. C. for 24 hrs. The results were compared with those obtained from the same steel in an untreated state quenched from 900 deg. C. and then hardened by slight cold-rolling, the rapid fall in the yield point being displaced about 50 deg. C. higher by reason of the double heat treatment.

The solubility in concentrated hydrochloric acid after certain treatment was increased by 400 per cent., but this only resulted from very long tempering for periods which could not usually be adopted in practice.

The carbide precipitation could be clearly recognised in the structure of the treated steel.

XUM

The Setback in Spelter.

By "Onlooker."

This year opened with great hopes for spelter, it being recognised that production as from December 1 last had been further reduced to but 50 per cent. of capacity, a rate which should help to bring down stocks to a reasonable level. Disappointment, however, was in store, for the December figures revealed an increase in the stocks, and since then the statistical position has given signs of deterioration, a process which has been reflected in falling values. In the States the quotation has dropped below 3 cents, and on the London Metal Exchange the value of prompt spelter has recently dipped to about £12, which means a gold equivalent of about £9. This is a new low record for the metal and one at which production for most mining companies is not a paying proposition.

Demand for this metal unfortunately shows no signs of improving, and in all directions, brass-making as well as galvanising, inquiry is much below normal. The imposition of a tariff has certainly not helped things, for consumers are faced with an increase in price on Empire brands which is adversely affecting them in competing on the export market. One effect of the imposition of the tariff was to increase materially the imports of spelter during February so as to clear the duty coming into force on March 1, and according to the London Metal Exchange statistics, Belgium, Poland and Scandinavia between them sent us during February about twelve times as much as in January. The amount of spelter available for use has therefore increased considerably, and this in turn has made for an easier tendency in the price. It must be remembered, of course, that an increase of stocks here has been at the expense of the European holding and that the sum total is unaltered.

Apparently at the recent Cartel conference it was suggested that a total shut down for two months of all production controlled by the Cartel should be instituted, but while this scheme has not by any means been abandoned, it is realised that much discussion and preparation will be necessary before such an undertaking can go through. In the meanwhile quotas are to remain as before, but it is obvious that, as far as this country is concerned, the Empire producers will have things entirely in their own hands. Fifty per cent. seemed an entirely adequate cut when it was instituted, but it is not proving enough to counterbalance the serious decline in consumption, which has fallen below the most pessimistic expectations. The difficulty which stands always in the way of reducing spelter production is the fact that this metal is to a great extent a by-product in the production of lead and silver, while it is also connected with the manufacture of sulphuric acid. For this very reason some opinions incline to the view that if demand for spelter fails to pick up, the world's needs may be satisfied through an output of zinc purely on the basis of a by-product, in which case the metal would presumably be sold for what it would fetch. This is taking a very pessimistic view of the future of spelter, but there is certainly room for some propaganda work on the slogan, "Use more zinc."

As a medium for speculation spelter has never been much to the fore, and even now, with the price standing so low, the contago of 7s. 6d. compares very unfavourably with the small carrying rate imposed on forward purchases of copper. Speculation, it may be argued, is no use to business people, but it does undoubtedly help at times to lift commodities out of the rut, and spelter is certainly well in the slough of despond at present.

Corrosion of Iron and Steel.

The activities of one of the important American Society for Testing Materials committees, namely, Committee A-5 on Corrosion of Iron and Steel, are in the line of investigations and tests to enable the best selection or evaluation of various qualities or types of iron and steel for services where corrosion is a factor and in the setting up of standards for materials or for metallic coatings adequately to meet the corrosion conditions.

The important work of the past year has been largely one of progress on projects under way. The original investigative work on atmospheric exposure of black-sheet materials has been largely completed and summarised in other years; but one set of test samples is still being observed at the Annapolis location. An important corollary of this is the investigation of the same materials under immersion conditions in various types of water. Some conclusions have been reached in the past, but much of this important work still is in progress, and it will be some time in the future when conclusion may safely be drawn. Most interesting extensions of the original work are in progress relating to the study of plate materials and rivets in sea and other water conditions prevalent in shipping service, including some test installations in actual vessel hulls. Aside from the important visual observations regularly made and reported upon, replicas are being made of the condition of plates and rivets at the periods of inspection which, at the completion of the tests, will furnish an interesting and important record of the progression of corrosion in the various materials. Observations thus far are most interesting, but are largely of progress, and here again it will be some time in the future when conclusions and evaluation are warranted.

In the field of testing, the committee is still quite actively interested in the study and development of tests of an accelerated nature by which judgment as to the suitability of materials for corrosion service may be more rapidly obtained. Unfortunately, in spite of much effort along these lines, there appears to be as yet no satisfactory accelerated tests which may be taken as properly indicating the value of iron and steel for the conditions met in actual service of the usual types.

A recent activity of the committee, and one which has been conducted so intensively that results are reaching a conclusion, is the important investigation of possible embrittlement of structural-steel members as a result of the operations incidental to application of galvanised protective coatings. It is of great importance to certain users, notably in connection with towers and accessories in electrical transmission. It is expected that the results of the investigation will be given to the Society at the June meeting in Atlantic City.

Setting up of suitable standards and specifications is necessarily of a continuing nature. Committee A-5 has set up as an important feature of its activities several specifications for zinc protective coatings for various types of iron and steel products. Other specifications of this type are under consideration and will be put forth as the need arises.

Errata.—Mr. P. Howden, the author of our article on "The Use of Pulverised Fuel and Pulverisers in the Foundry," which appeared in our issue of March 10, points out the reference to Fig. 1 at the top of column 1 of page 159 has inadvertently been made instead of to Fig. 2. He also desires us to state that the illustration, Fig. 2, was supplied by courtesy of Messrs. Mason & Burns, Limited, malleable iron founders, Walsall, where this plant is in operation.

Inclusions in Steel.

The American Institute of Mining and Metallurgical Engineers has issued Technical Publication No. 453 on "Inclusions—Their Effect, Solubility and Control in Cast Steel," by Messrs. C. E. Sims and G. A. Lilliequist. We append the authors summary.

There is a direct relationship between the character and distribution of inclusions in cast steel and the ductility of such steels.

The globular type of inclusion scattered haphazardly through the steel has the minimum effect on the physical properties.

The eutectic type which forms a network in the steel causes the steel to rupture after slight plastic flow with resultant low ductility.

The variations in quantity of inclusions ordinarily found in steel have almost no effect on the physical properties.

The normal inclusion-forming material of steel is soluble in the molten state and precipitates as inclusions at the time of solidification.

If the iron-oxide content of the steel is high, the inclusions will precipitate at the beginning of solidification and will exist as globules of silicates and sulphides, and the steel will have good ductility.

If the iron-oxide content of the steel is too low, the solubility of the sulphides is increased to such an extent that they precipitate as a eutectic with the last steel to freeze. The ductility of such steel will be low.

Metallographic Testing Standards.

Committee E-4 on Metallography, of the American Society for Testing Materials, at its meeting in Cleveland on Tuesday, March 8, decided completely to revise and combine into one standard the two existing methods of metallographic testing. Subcommittee I on Selection and Preparation of Samples met in an afternoon session and reported to the main committee in the evening session. The subcommittee considered the Standard Methods E 3-24, Metallographic Testing of Iron and Steel, and E 5-27, Metallographic Testing of Non-Ferrous Metals and Alloys, and decided to rewrite these two specifications and to combine them into one specification. By this combination the general subject-matter common to both specifications could be written once to apply to both specifications, and then the special subject-matter pertaining to iron and steel and non-ferrous metals and alloys can be given under two separate headings. Mr. C. J. Tobin, General Motors Corporation, Chairman of the Special Subcommittee on Grain Characteristics of Steel, reported for his committee. The plan adopted by this committee is to prepare a grain-size chart representing a series of eight photomicrographs which show the grain-size range with sizes 1 to 5 representing coarse grain and representing those materials which give large well-defined grains in the hypereutectoid zones of carburised specimens, and a series 5 to 8 representing those materials which give fine grain in the same zone. Such a chart is considered necessary, because at the present time such materials are bought on grain-size specification, and there are in existence at least four or five different charts. Charts proposed by this committee are now considered acceptable to both producers and consumers. Members of the committee feel sure that such a chart is applicable to the S.A.E. and allied steels, and that the same chart or similar charts may be applicable to other steels. The committee hopes to have its report and chart ready for consideration by Committee E-4 at its June meeting.

This Week's News in Brief.

Trade Talk.

Messrs. Swan, Hunter & Wigham Richardson, Limited, have launched the single-screw steamer "Lakeshell" from their Neptune Yard, Walker-on-Tyne. The ship is an oil tanker, built for Canadian owners.

A contract has been placed by the Leith Dock Commission with Messrs. Cowans, Sheldon & Company, Limited, Carlisle, for the supply of four wharf cranes for the Imperial Dock, at a cost of about £10,000.

An extraordinary general meeting of the Société de Métallurgie Basset has approved a proposal to raise the share capital of the company from 375,000 fcs. to 626,500 fcs. by the issue of new 500-fc. shares at par.

Consequent upon our supplying Messrs. William Cumming & Company, Limited, of Glasgow, and elsewhere, with a revised list of Danish iron-founders, they have had the commendable enterprise to issue a sales letter in the Danish language.

Messrs. Pittevil & Company announce that from Wednesday, March 23, 1932, their address will be changed from 22, Laurence Pountney Lane, E.C.4, to 76, Windsor House, 46, Victoria Street, London, S.W.1. The telephone number is Victoria 7946 and the telegraphic address, Pittevil, Sowest, London.

Within 72 hours a new rudder was forged last week by the Sunderland Forge & Engineering Company, Limited, conveyed to West Hartlepool and fitted to a steamer there by Messrs. William Gray & Company, Limited, shipbuilders. The achievement is claimed as a record, the time usually occupied in such work being 10 days.

New Government contracts listed in the "Ministry of Labour Gazette" include the following:—*Admiralty.*—Chain cable and gear: Brown, Lenox & Company, Limited, Pontypridd; J. G. Walker & Son, Limited, Old Hill; N. Hingley & Sons, Limited, Netherton; H. Wood & Company, Limited, Saltney; Woodhouse Bros., Cradley Heath. Chequered steel plates: British (Guest Keen Baldwins) Iron & Steel Company, Limited, Cardiff; Consett Iron Company, Limited, Consett; South Durham Steel & Iron Company, Limited, Middlesbrough. Propellers: Manganese Bronze & Brass Company, Limited, London. *War Office.*—Aluminium ingot: British Aluminium Company, Limited, Warrington. Expanded metal sheets, etc.: Expanded Metal Company, Limited, West Hartlepool; British Reinforced Concrete Engineering Company, Limited, Stafford. Fuel-pulverising plant: A. Herbert, Limited, Coventry. Steel guttering, sheets, etc.: Burnell & Company, Limited, Ellesmere Port. Steel rounds: Colvilles, Limited, Motherwell. *Crown Agents for the Colonies.*—Coal hoist: Mitchell Conveyor & Transporter Company, Limited, London. Steel culverts: Walls, Limited, Birmingham. Steel tubes: Stewarts & Lloyds, Limited, Glasgow. Steelwork: Alex. Findlay & Company, Limited, Motherwell; Horsehay Company, Limited, Horsehay.

Personal.

Mr. J. Railing, joint managing director of the General Electric Company, Limited, has been elected chairman of the Council of the British Electrical and Allied Manufacturers' Association for the coming year.

Alderman J. O. Whitehouse, J.P., of Cannock, who is prominently connected with the iron and steel trade of the district, has been unanimously re-elected chairman of the Staffordshire County Education Committee.

The many friends of Mr. F. K. Neath, B.Sc., will be interested to learn that he has resigned his position with the British Cast Iron Research Association to join the Keighley Laboratories, Limited, Keighley, Yorkshire, the well-known firm of metallurgists, analytical chemists and engineering consultants. Mr. Neath has occupied an important position with the British Cast Iron Research Association for the past eight years, and is well known as the Honorary Secretary of the Birmingham, Coventry and West Midlands Branch of the Institute of British Foundrymen, and was jointly responsible for the organisation of the last annual conference of the Institute.

Company Reports.

A. Reyrolle & Company, Limited.—Dividend of 12½ per cent. on the ordinary shares for 1931.

Steel Company of Canada, Limited.—Quarterly dividend of 43¾ cents per share on the common stock.

Stewarts & Lloyds, Limited. — The directors announce that they do not propose to pay a dividend on the deferred shares or liaison deferred shares for the year 1931.

International Nickel Company of Canada, Limited.—Earnings, $10,556,000; other income, $499,792; office expenses, $1,328,206; reserved for taxes, $507,277; interest, $439,355; depreciation, etc., $3,010,476; retirement, insurance and other reserves, $675,979; net profit, $5,094,497; preferred dividend, $1,933,938; common dividend of 45 c. per share, $6,560,468; surplus, $16,757,813.

British Aluminium Company, Limited.—Profit for 1931, including the amount brought forward, after making provision for taxation, and after charging the amounts required for the interest upon the prior lien debentures and the debenture stock, and after setting aside £50,000 to depreciation reserve and £10,000 to the staff benefit fund, is £159,923. After providing for preference dividend, the directors recommend 5 per cent. for the year on the ordinary share capital, leaving £49,872 to be carried forward.

Contracts Open.

Blaengarw, April 2.—Supply and laying of 1,550 yds. of 9-in. dia., and 192 yds. of 6-in. dia., cast-iron pipes, with valves, etc., for the Mid-Glamorgan Water Board. Messrs. Thomas & Morgan & Partners, civil engineers, Pontypridd, Glam. (Fee £5 5s., returnable.)

Edinburgh, April 4.—Iron and steel stores, for the Corporation Gas Department. Mr. H. H. Gracie, manager, 15, Calton Hill, Edinburgh.

Erith, April 4.—Centrifugal pumps, for the Urban District Council. Mr. H. Hind, surveyor, Council Offices, The Oaks, Belvedere. (Fee £1 1s., returnable.)

Galloway, April 8.—One 60-ton and one 50-ton overhead electric travelling crane, for the Galloway Water Power Company. Mr. T. Lawrie, secretary, Galloway Water Power Company, Queen's House, Kingsway, London, W.C.2. (Fee £2 2s., returnable.)

Haywards Heath, April 6.—233 tons of cast-iron pipes of 5 in. dia., and specials, 4 in. and 3 in. dia., for the Mid-Sussex Joint Water Board. Mr. F. Martin, engineer, Waterworks Offices, Boltro Road, Haywards Heath. (Fee £2 2s., returnable.)

Southborough, April 5.—Supply and laying of 212 yds of 3-in. cast-iron water main, for the Urban District Council. The Council Offices, Southborough.

Woking, April 12.—Centrifugal pumps, electric motors, and equipment, for the Urban District Council. Mr. G. Gould Marsland, Surveyor, Council Offices. (Fee £3 3s., returnable.)

Obituary.

Mr. Samuel Bayliss, chairman of Messrs. Bayliss, Jones & Bayliss, Limited, Wolverhampton, died at his home at Tettenhall, Wolverhampton, on Saturday, March 19. He was in his 85th year. With his brother, the late Mr. William Bayliss, he was associated with the business all his working life, the firm having been founded in 1826. He was a county magistrate for many years, and for eleven years was a member of the Tettenhall Urban Council—for ten years filling the position of chairman.

The Practical Foundryman, March 24.—Mr. E. Longden wishes us to correct the following errors which occurred in transferring this Paper to print:—

Page 191, column 1, line 48, should read: "the practical foundry manager is *so* and not *also*." And, again, in the second column the second paragraph should read: "Briefly my point is that modern education *has* put into the hands of the practical foundryman sufficient knowledge, etc."

Fatigue of Metals.

The American Society for Testing Materials Committee on Fatigue of Metals held a very interesting and well-attended meeting in Cleveland on March 8. The committee is now engaged in preparing summaries of present-day knowledge of corrosion-fatigue and of the significance of fatigue to designers and users of structures and machines. This summary, when available, will supplement the Report on Present-day Experimental Knowledge and Theories of Fatigue Phenomena in Metals. This earlier report was a concise presentation on present views regarding fatigue phenomena in metals, and included statements on endurance limits; correlation of endurance limit with other physical properties; effect of range of stress and kind of stress on fatigue strength; fatigue of metals as affected by metallographic features; fracture under repeated stress; mechanical hysteresis and fatigue; detection of incipient fatigue failures; effect of alloying and heat-treatment on the endurance limit of steel; overstressing in fatigue; cold working; strengthening by understressing; stress concentration and fatigue strength; and the significance of fatigue test results.

Rotary Melting Furnaces.

In the Court of Appeal on March 15 the Master of the Rolls, and Lord Justices Lawrence and Romer, heard an appeal by Brackelsberg Melting Processes, Limited, the defendants in a patent action against them by Messrs. Pittevil & Company, which was decided by Mr. Justice Luxmore in the Chancery Division.

Mr. Trevor Watson, K.C., for appellants, said that the action was to restrain defendants from making threats of legal proceedings under the Patent Acts. Defendants were the licensees in this and other countries of all letters patent granted to Carl Brackelsberg, a German.

Messrs. Pittevil & Company had some interest in this country in respect to certain inventions under which they manufactured a furnace called the Sesci furnace. The Brackelsberg concern, apprehending that the Sesci furnace would infringe their patent, issued threatening letters to customers of the plaintiffs, and also alleged that the furnace infringed their patent.

The appellants admitted publication of the threatening letters, and sought to justify them. The question was whether there was an infringement of the Brackelsberg patent and whether it was valid.

At the court below defendants elected to call no evidence, and the Judge held that plaintiffs had established that there was no infringement of the patent, but that they had failed to establish that the patent was invalid.

Mr. A. Colefax, K.C., for respondents, said that their case was that the Sesci furnace was distinct from the Brackelsberg furnace, which had a preliminary chamber, and secondly, that they did not employ high pressure within the meaning of the specification.

After hearing argument of counsel, their Lordships held that there was sufficient to justify the Judge in holding that there was no infringement of the patent, and in giving the relief he did. The appeal was dismissed with costs.

New Companies.

Acelite, Limited.—Capital, £100. Ironfounders, etc. Solicitors: Hooper & Fairbairn, 1, Priory Street, Dudley.

H. Schubert, Limited.—Capital, £1,000. Ironfounders. Solicitors: Buckeridge & Braune, 3 & 4, Clements Inn, London, W.C.

Lysaght Protected Steel Company, Limited, Orb Ironworks, Newport.—Capital, £20,000. Directors: S. A. Putnam, Hon. H. C. H. Bathurst, A. Lakeman and B. Green.

British & Continental Traders, Limited, announce that their address is now Lincoln House, High Holborn, London, W.C.1.

AIR COMPRESSORS IN THE FOUNDRY

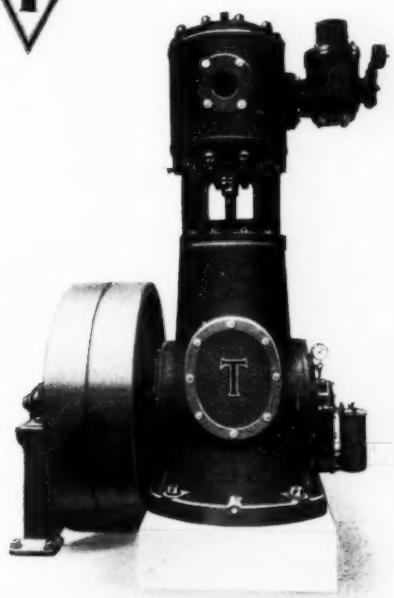
All sizes up to 3,000 cu. ft. capacity.

TILGHMANS

The use of pneumatic tools in the Foundry is steadily increasing, demanding for their efficient operation a steady unvarying volume of compressed air.

INSTALL A TILGHMAN COMPRESSOR.

The machine with a guaranteed performance of the highest efficiency.



TILGHMAN'S
AIR COMPRESSOR CO.
(Proprietors: TILGHMAN'S PATENT SAND BLAST Co. Ltd.),
BROADHEATH, NR. MANCHESTER.
London Office: 17, Grosvenor Gardens, S.W.1.

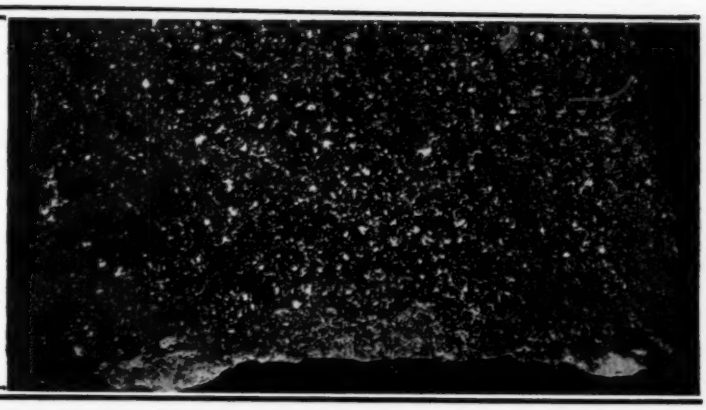
281029. H. D

PIG IRON

MANUFACTURERS of Foundry, Basic and Hematite qualities.

Delivery from stock.

Booklet giving analyses, etc., will be sent on request.



DORMAN LONG & COMPANY LTD., Incorporating
BOLCKOW VAUGHAN & Co., Ltd., MIDDLESBROUGH

DORMAN LONG

Raw Material Markets.

There has been little movement in the iron and steel markets during the past week, owing to the Easter holidays. Since the resumption of activities business has been slack, and the outlook remains uncertain. Orders are scarce in the finished-steel market, and increased competition is being experienced from the Continent, in spite of the 10 per cent. duty.

Pig-Iron.

MIDDLESBROUGH.—There is little demand for pig-iron, owing to the lean state of consumers' order books. Sales to Scotland have decreased, if anything, owing to the competition of Indian and Midlands brands; this in spite of the special price concessions offered to Scottish buyers. There is not likely to be any increase in output, the production of the 17 furnaces now in blast being sufficient to satisfy the needs of the local steelworks and the general market. The fixed minimum prices are unaltered, quotations being:—No. 1 foundry iron, 61s.; No. 3 G.M.B., 58s. 6d.; No. 4 foundry, 57s. 6d.; No. 4 forge, 57s. per ton, f.o.t.

In spite of the number of inquiries circulating in the East Coast hematite market, the number of actual orders booked remains small. The makers' quotation for ordinary mixed numbers is 63s. 6d. per ton, but this figure is being shaded by well-stocked merchants. Nearly all sales are for early delivery, forward buying being almost entirely absent. On the West Coast little business has materialised from the recent American and Dominion inquiries, and only limited purchases are being made. Bessemer mixed numbers remain at 66s. per ton at works, with low-phosphorus iron 2s. 6d. to 5s. per ton more.

LANCASHIRE.—Several new contracts for foundry iron have been reported, but the movement is far from general. The depression in the textile industry is unrelieved, with a resultant ill-effect on markets in this part of the country. France's intention to restrict imports of British textile machinery is also disquieting news. The jobbing foundries in this area are badly in need of employment. Quotations are steady, with Staffordshire, Cleveland and Derbyshire No. 3 on offer for delivery to users in the Manchester price zone at 67s. per ton, Northamptonshire foundry at 65s. 6d., Derbyshire forge at 62s., Scottish pig-iron at from 86s. 6d. to 87s., and West Coast hematite iron at about 81s. per ton.

MIDLANDS.—Forward buying of pig-iron in this market is almost entirely absent, many consumers still being covered for several weeks ahead. The general and heavy engineering trades remain depressed. There has been no change in prices, which remain at 62s. 6d. per ton for No. 3 Northants and 66s. for North Staffordshire, Derbyshire and Lincolnshire No. 3, including delivery to Birmingham and Black Country stations or sidings.

SCOTLAND.—There is no change to report in market conditions. The price of No. 3 Scottish foundry iron remains at 69s. 6d. per ton f.o.t. furnaces, with a minimum of 2s. 6d. per ton extra for No. 1. There are still only three furnaces making foundry iron. There are rumours of foreign iron being quoted at very low prices, but so far no actual business has been reported.

Coke.

The coke market in the Midlands has remained stationary during the past week or so, no forward buying being witnessed. Best Durham foundry coke is offered at between 35s. and 37s. 6d. per ton, according to analysis, while Welsh coke varies from 30s. to 45s. per ton, delivered in the Birmingham district.

Steel.

There has been considerable competition in the finished-steel market for the few orders booked. Small steel bars are being imported from the Continent at a price which renders the 10 per cent. tariff useless as a protection to the home works, the competitive power of the latter having been weakened by enforced reductions in output. There is no improvement in the demand for semi-finished material, either of home or Continental origin. There are still large stocks of Continental semis in this country, bought before the imposition of the tariff, and until these are liquidated the market cannot be expected to resume its normal course.

Scrap.

In the Cleveland scrap-iron market heavy material has again fallen in value, ordinary cast iron now being quoted at 40s. and good machinery quality at 42s. 6d. per ton. Light castings are, at the most, at 35s. per ton. Little business has been done in the Midlands owing to the holidays, and to the fact that consumers themselves are so short of orders. In Scotland the foundries have little incentive to buy, and machinery cast-iron scrap is easy at 51s. 6d. to 52s. 6d. per ton, with ordinary cast iron at 47s. 6d. and light metal at 40s. per ton.

Metals.

Copper.—Standard copper has opened the new season weakly, chiefly on account of disquieting advice from New York and the improvement in the sterling exchange. Copper Exporters, Inc., have reduced the official price from 6⅞ cents to 6¼ cents per lb. c.i.f. Europe, at the same time withdrawing the quotation of 6¼ cents which had been temporarily allowed to the Customs smelters. The market had been disturbed for some time by these cheap offers, as consumption on both sides of the Atlantic is so low at the moment. With regard to the new output-curtailment scheme, evidence of the producers' good faith is given by the announcement of the Phelps Dodge Corporation that it is to reduce even further the production of the mines under its control.

Closing quotations:—

Cash.—Wednesday, £33 1s. 3d. to £33 2s. 6d.; Thursday, £32 15s. to £32 16s. 3d.; Tuesday, £31 17s. 6d. to £31 18s. 9d.; Wednesday, £31 12s. 6d. to £31 15s.

Three Months.—Wednesday, £33 3s. 9d. to £33 5s.; Thursday, £32 17s. 6d. to £32 18s. 9d.; Tuesday, £32 2s. 6d. to £32 5s.; Wednesday, £31 15s. to £31 16s. 3d.

Tin.—The standard market has been affected by the movements of the exchanges. Little support has been forthcoming during the last day or two, Tuesday in particular recording a fall of £8 5s. in the cash quotation. Operators remain nervous. The occurrence of the Easter holidays has, of course, kept many consumers off the market. From the communiqué following the meeting of the Pool in Paris last week, it is inferred that further restriction of production has been agreed upon, the contentious point being the date of commencement. The matter is to be further discussed on April 22.

Official closing prices:—

Cash.—Wednesday, £128 10s. to £128 15s.; Thursday, £126 7s. 6d. to £126 12s. 6d.; Tuesday, £118 2s. 6d. to £118 5s.; Wednesday, £120 10s. to £120 15s.

Three Months.—Wednesday, £130 5s. to £130 7s. 6d.; Thursday, £128 2s. 6d. to £128 5s.; Tuesday, £119 10s. to £119 12s. 6d.; Wednesday, £122 to £122 5s.

Spelter.—Little inquiry has been received on the market and quotations have moved slowly downward, in sympathy with the other metals. Quotations for March shipment lost 13s. 9d. last week, and a further heavy fall was recorded on Tuesday. The outlook remains very clouded.

Daily fluctuations:—

Ordinary.—Wednesday, £12 8s. 9d.; Thursday, £12 5s.; Tuesday, £11 7s. 6d.; Wednesday, £11 15s.

Lead.—At the end of last week the New York quotation was reduced by 15 points to 3 cents per lb.—an ample indication of the poor state of this market. Production may be restricted at the mines, but there will be no improvement in the actual position until there is a definite recovery in consumption—a development which it is hard to visualise at the moment of writing.

The week's prices have been:—

Soft Foreign (Prompt).—Wednesday, £12 3s. 9d.; Thursday, £11 17s. 6d.; Tuesday, £11 11s. 3d.; Wednesday, £11 15s.

Catalogues Received.

Firebricks.—The Priestman Collieries, Millburn House, Newcastle-upon-Tyne, have utilised a 28-page booklet to present, in an interesting and orderly fashion, data about the Cowen brands of firebrick. Those carrying the mark "M" are machine made—a simple and useful distinction in works carrying a varied stock. Some data are given on the preparation of fireclay for setting, and this is followed by an illustrated description of the laboratory control. The balance of the booklet illustrates dimensions and stock sizes, and closes with a quantity of useful technical data.

Coke.—Three rather dainty brochures have been received from the Priestman Collieries, Limited, Millburn House, Newcastle-upon-Tyne. They bear the captions "Low-Ash Foundry Coke," "Foundry Coke" and "How Coke Nuts Save Work in the Home." Dealing with them *seriatim*, the first, in an eight-page brochure discloses the composition (ash 4.5 per cent.), gives surface, sectional and radiographical photographs, whilst interpreting all along the import of these factors. The second treats similarly with a by-product coke (6.5 per cent. ash), and discloses information, which ought to have been vouchsafed in the former publication, that the low-ash coke is from beehive ovens. The third one is for more general perusal and is less technical. The character of the dust produced is one which appeals to us as a user of Coalite. This otherwise excellent fuel is much vitiated by the fluffy character of the ash.

Fans.—No industry is more interested in fans than the modern foundry. Whilst an elaborate fume-exhausting system may be installed, yet one finds corners and pockets in the works where fumes are inclined to gather, and the up-to-date shop invariably takes care of these by installing supplementary fans built in the walls. In their latest catalogue—VI—Messrs. James Keith & Blackman Company, Limited, 27, Farringdon Avenue London, E.C.4, rightly stress this aspect. This publication is of the type one carefully files for reference, as it contains a mass of extremely useful technical and commercial data. We have just one criticism to make and that is the absence of a code, unless it be contained in next to the last column but one of the various tables, which give a composite computation of the diameter of the wheel and the motor-frame size.

Rotary Compressors.—James Keith & Blackman Company, Limited, 27, Farringdon Avenue, London, E.C.4, have sent us an advance copy of their publication G 57, which in 16 pages illustrates and describes a range of rotary compressors for air and gas. The range covers belt, electric-motor and gas-engine driven machines. The last few pages are devoted to valves and an air filter—the last an essential for reducing wear and tear on the compressor. There is a characteristic uniformity about the publicity matter issued by this house, which makes it readily recognisable, and is of a high standard.

The British Aluminium Company, Limited, of Adelaide House, King William Street, London, E.C.4, wish to correct a mis-statement which appeared in their advertisement on page 15 of our issue of March 10. Herein it was stated that the minimum ultimate tensile strength was 1 ton per sq. in., whereas, as is well known, **"Y" alloy invariably reaches 11 tons tensile in the** "as cast" condition.

Sterling

ROLLED STEEL
MOULDING BOXES
INCREASE OUTPUT
AND
CHEAPEN PRODUCTION

In the course of a day's work each box part must be handled several times. For quantity production, therefore, light moulding boxes are essential.

To withstand the brunt of rapid handling and the heavy pressures of the modern moulding machine, the box must be strong, rigid and unbreakable.

For the production of castings true to pattern free from fins and crossed joints, accurate moulding boxes are not only necessary but vital.

THE SOLUTION IS
THE STERLING ROLLED STEEL BOX

In no other type of moulding box will you find such uniform accuracy of pins and parting faces, nor just that correct ratio of the necessary factors to ensure long life without undue weight.

LET US HAVE YOUR ENQUIRY FOR YOUR NEXT LOT OF BOXES.

STERLING FOUNDRY SPECIALTIES LTD.
BEDFORD.

London Office:
13, VICTORIA STREET, S.W.1.

Telephone: 3345 BEDFORD.
Telegrams: "STERFLASK, BEDFORD."
Code: WESTERN UNION.

Glasgow: ALBERT SMITH & CO., 60, ST. ENOCH SQUARE, GLASGOW, C.1.
Newcastle-on-Tyne: LAWSON, WALTON & CO., HANDYSIDE ARCADE, NEWCASTLE-ON-TYNE.
Manchester: F. L. HUNT & CO., CHAPEL STREET, SALFORD, MANCHESTER.

WEEKLY PRICE CURRENT.

COPPER.

	£ s. d.
Standard cash	31 12 6
Three months	31 15 0
Electrolytic	35 0 0
Tough	35 10 0
Best selected	36 0 0
Sheets	66 0 0
India	47 0 0
Wire bars	37 0 0
Do., May	36 15 0
Do., June	36 10 0
Ingot bars	36 10 0
H.C. wire rods	40 0 0
Off. av. cash, Feb.	36 19 8⅛
Do., 3 mths., Feb.	36 14 2½
Do., Sttlmnt., Feb.	36 19 3½
Do., Electro, Feb.	41 15 11½
Do., B.S., Feb.	40 10 0
Do., wire bars, Feb.	42 4 3½
Solid drawn tubes	10d.
Brazed tubes	10d.
Wire	6½d.

BRASS.

Solid drawn tubes	9½d.
Brazed tubes	11½d.
Rods, drawn	8½d.
Rods, extd. or rlld.	4½d.
Sheets to 10 w.g.	7½d.
Wire	7½d.
Rolled metal	7½d.
Yellow metal rods	4½d.
Do. 4 × 4 Squares	5½d.
Do. 4 × 3 Sheets	5½d.

TIN.

	£ s. d.
Standard cash	120 10 0
Three months	122 0 0
English	122 5 0
Bars	121 10 0
Straits	121 7 6
Australian	119 12 6
Eastern	126 0 0
Banca (nom.)	117 2 6
Off. av. cash, Feb.	139 4 7½
Do., 3 mths., Feb.	141 17 2½
Do., Sttlmt., Feb.	139 4 6½

SPELTER.

	£ s. d.
Ordinary	11 15 0
Remelted	9 15 0
Hard	10 0 0
Electro 99.9	14 12 6
English	13 0 0
India	11 5 0
Zinc dust	22 0 0
Zinc ashes	2 10 0
Off. aver., Feb.	14 1 7½
Aver. spot, Feb.	13 17 5½

LEAD.

	£ s. d.
Soft foreign ppt.	11 15 0
English	13 10 0
Off. average, Feb.	14 11 3½
Average spot, Feb.	14 11 2½

ZINC SHEETS, &c.

	£ s. d.
Zinc sheets, English	24 0 0
Do., V.M. ex-whf.	22 10 0
Rods	28 0 0
Boiler plates	—
Battery plates	—

ANTIMONY.

	£ s. d.
Special brand Eng.	40 0 0
Chinese	27 10 0
Crude	28 0 0

QUICKSILVER.

	£ s. d.
Quicksilver	17 10 0

FERRO-ALLOYS AND STEEL-MAKING METALS.

Ferro-silicon—	
25%	£7 15 0
45/50%	£13 0 0
75%	£17 17 6
Ferro-vanadium—	
35/50%	12/8 lb. Va.
Ferro-molybdenum—	
70/75% c. free, 4/2, plus 55%, per lb. of Mo.	
Ferro-titanium—	
23/25% carbon-free	11½d. lb.
Ferro-phosphorus, 20/25%	£22 10 0
Ferro-tungsten—	
80/85%	1/8½ lb. plus 20%
Tungsten metal powder—	
98/99%	1/11½ lb. plus 20%
Ferro-chrome—	
2/4% car.	£37 5 0
4/6% car.	£26 10 0
6/8% car.	£23 17 6
8/10% car.	£23 10 0
Ferro-chrome—	
Max. 2% car.	£40 5 0
Max. 1% car.	£49 0 0
Max. 0.70% car.	£56 2 6
70% carbon-free	1/1½ lb.
Nickel—80/99.5%	£220 to £225
"F" nickel shot	£212 10 0
Ferro-cobalt	10/- lb.
Aluminium 98/99%	£95 0 0
Metallic chromium—	
96/98%	3/- lb.
Ferro-manganese (net)—	
76/80% loose	£10 15 0 to £11 5 0
76/80% packed	£11 15 0 to £12 5 0
76/80% export	(nom.) £9 0 0
Metallic manganese—	
94/96% carbon-free	1/6 lb.

Per ton unless otherwise stated.

HIGH-SPEED TOOL STEEL.

Finished bars, 14% tungsten	2s. 0d.
Finished bars, 18% tungsten	2s. 9d.

Per lb. net, d/d buyers' works.

Extras—	
Rounds and squares, 3 in. and over	4d. lb.
Rounds and squares, under ½ in. to ¼ in.	3d. lb.
Do., under ¼ in. to 5/16 in.	1/- lb.
Flats, ½ in. × ¼ in. to under 1 in. × ⅛ in.	3d. lb.
Do., under ½ in. × ¼ in.	1/- lb.
Bevels of approved sizes and sections	6d. lb.

Bars cut to length, 10% extra.

SCRAP.

South Wales—	£ s. d.	£ s. d.
Heavy steel	2 5 0	to 2 7 6
Bundled steel and shrngs.	1 17 0	to 1 18 0
Mixed iron and steel	2 0 0	to 2 1 0
Heavy cast iron	2 6 0	to 2 7 0
Good machinery for foundries	2 10 0	
Cleveland—		
Heavy steel	1 15 0	
Steel turnings	1 12 6	
Cast-iron borings	1 6 0	
Heavy forge	2 15 0	
W.I. piling scrap	2 7 6	
Cast-iron scrap	2 0 0	to 2 2 6
Midlands—		
Light cast-iron scrap	1 17 6	
Heavy wrought iron	2 10 0	
Steel turnings, f.o.r.	1 0 0	
Scotland—		
Heavy steel	1 17 6	
Ordinary cast iron	2 7 6	
Engineers' turnings	1 8 6	
Cast-iron borings	1 11 0	
Wrought-iron piling	2 5 0	
Heavy machinery	2 11 6	

London—Merchants' buying prices delivered yard.

	£ s. d.
Copper (clean)	29 0 0
Brass	21 0 0
Lead (less usual draft)	11 0 0
Tea lead	8 0 0
Zinc	6 0 0
New aluminium cuttings	72 0 0
Braziery copper	24 0 0
Gunmetal	24 0 0
Hollow pewter	80 0 0
Shaped black pewter	60 0 0

PIG-IRON.

(f.o.t. unless otherwise stated.)

N.E. Coast—	
Foundry No. 1	61/-
Foundry No. 3	58/6
Foundry No. 4	57/6
Forge No. 4	57/-
Hematite No. 1	64/-
Hematite M/Nos.	63/6
N.W. Coast—	
Hem. M/Nos. d/d Glas.	73/-
,, d/d Birm.	84/6
Malleable iron d/d Birm.	117/6
Midlands—	
Staffs common*	—
,, No. 4 forge*	61/-
,, No. 3 fdry.*	66/-
Shrops basic	—
,, Cold blast, ord.	—
,, ,, roll iron	—
Northants forge*	57/6
,, fdry. No. 3*	62/6
,, fdry. No. 1*	65/6
Derbyshire forge*	61/-
,, fdry. No. 3*	66/-
,, fdry. No. 1*	69/-
,, basic*	—

*d/d Black Country dist.

Scotland—	
Foundry No. 1	72/-
,, No. 3	69/6
Hem. M/Nos. d/d	68/6
Sheffield (d/d district)—	
Derby forge	58/6
,, fdry. No. 3	63/6
Lincs forge	—
,, fdry. No. 3	63/6
E.C. hematite	74/6
W.C. hematite	83/6
Lancashire (d/d eq. Man.)—	
Derby forge	62/-
,, fdry. No. 3	67/-
Staffs fdry. No. 3	67/-
Northants fdry. No. 3	65/6
Cleveland fdry. No. 3	67/-
Dalzell, No. 3 (special)	102/6 to 105/-
Glengarnock, No. 3	86/6 to 87/-
Clyde, No. 3	86/6 to 87/-
Monkland, No. 3	86/6 to 87/-
Summerlee, No. 3	86/6 to 87/-
Eglinton, No. 3	86/6 to 87/-
Gartsherrie, No. 3	86/6 to 87/-
Shotts, No. 3	86/6 to 87/-

FINISHED IRON AND STEEL.

Usual District deliveries for iron; delivered consumers' station for steel.

Iron—	£ s. d.	£ s. d.
Bars (cr.)	9 15 0	to 10 0 0
Nut and bolt iron	8 7 6	to 8 10 0
Hoops	10 10 0	to 12 0 0
Marked bars (Staffs) f.o.t.	12 0 0	
Gas strip	10 10 0	to 12 0 0
Bolts and nuts, ¾ in. × 4 in.	12 2 6	
Steel—		
Plates, ship, etc.	8 15 0	to 8 17 6
Boiler plts.	8 10 0	to 9 5 0
Chequer plts.	10 7 6	
Angles	8 7 6	
Tees	9 7 6	
Joists	8 15 0	
Rounds and squares, 3 in. to 5½ in.	9 7 6	
Rounds under 3 in. to ⅜ in. (Untested)	6 12 6	& up.
Flats—8 in. wide and over	8 12 6	
,, under 8 in. and over 5 in.	8 17 6	
Rails, heavy	8 5 0	to 8 10 0
Fishplates	12 0 0	
Hoops (Staffs)	9 10 0	
Black sheets, 24g.	8 0 0	to 8 10 0
Galv. cor. shts.	9 10 0	to 10 0 0
Galv. flat shts.	10 0 0	to 11 0 0
Galv. fencing wire, 8g. plain	12 10 0	
Billets, soft	5 5 0	to 5 10 0
Billets, hard	6 12 6	
Sheet bars	4 15 0	to 5 5 0
Tin bars	4 15 0	

PHOSPHOR BRONZE.

	Per lb. basis.
Strip	10¾d.
Sheet to 10 w.g.	11½d.
Wire	12½d.
Rods	11¼d.
Tubes	16½d.
Castings	12½d.

Delivery 3 cwt. free.
10% phos. cop. £30 above B.S.
15% phos. cop. £35 above B.S.
Phosphor tin (5%) £30 above price of English ingots.
C. Clifford & Son, Limited.

NICKEL SILVER, &c.

	Per lb.
Ingots for raising	7d. to 1/1
Rolled—	
To 9 in. wide	1/1 to 1/7
To 12 in. wide	1/1½ to 1/7½
To 15 in. wide	1/1½ to 1/7½
To 18 in. wide	1/2 to 1/8
To 21 in. wide	1/2½ to 1/8½
To 25 in. wide	1/3 to 1/9
Ingots for spoons and forks	7d. to 1/3½
Ingots rolled to spoon size	10d. to 1/6½
Wire round—	
to 10g.	1/4½ to 1/11½

with extras according to gauge.
Special 5ths quality turning rods in straight lengths, 1/3½ upwards.

AMERICAN IRON AND STEEL.

At Pittsburgh unless otherwise stated.

	Dols.
No. 2 foundry, Phila.	15.64
No. 2 foundry, Valley	15.00
No. 2 foundry, Birm.	11.00
Basic	16.39
Bessemer	17.39
Malleable	17.39
Grey forge	16.89
Ferro-mang. 80% seaboard	75.00
O.-h. rails, h'y, at mill	43.00
Billets	27.00
Sheet bars	26.00
Wire rods	37.00
	Cents.
Iron bars, Phila.	2.11
Steel bars	1.50
Tank plates	1.50
Beams, etc.	1.50
Skelp, grooved steel	1.50
Skelp, sheared steel	1.50
Steel hoops	1.65
Sheets, black, No. 24	2.20
Sheets, galv., No. 24	2.85
Wire nails	1.95
Plain wire	2.20
Barbed wire, galv.	2.60
Tinplates, 100-lb. box	$4.75

COKE (at ovens).

Welsh foundry	22/6 to 27/6
,, furnace	17/6 to 18/-
Durham and Northumberland—	
,, foundry	14/6 to 15/-
,, furnace	13/6
Midlands, foundry	—
,, furnace	—

TINPLATES.

f.o.b. Bristol Channel ports.

I.C. cokes 20×14 per box	16/-
,, 28×20 ,,	32/-
,, 20×10 ,,	23/-
,, 18¾×14 ,,	16/7½
C.W. 20×14 ,,	14/-
,, 28×20 ,,	30/-
,, 20×10 ,,	19/10
,, 18¾×14 ,,	15/-

SWEDISH CHARCOAL IRON & STEEL.

Pig-iron	£6 0 0 to £7 0 0
Bars, hammered, basis	£16 10 0 to £17 0 0
Bars and nail-rods, rolled, basis	£15 17 6 to £16 5 0
Blooms	£10 0 0 to £12 0 0
Keg steel	£32 0 0 to £33 0 0
Faggot steel	£18 0 0 to £23 0 0
Bars and rods dead soft, st'l	£10 0 0 to £12 0 0

All per English ton, f.o.b. Gothenburg.
[Subject to an exchange basis of Kr. 18.16 to £1.]

TUBES AND FITTINGS.

Current Discounts.

	Tubes.	*Fittings.*
Gas	65%	57½%
Water ..	61¼%	52½%
Steam ..	57½%	47½%

DAILY FLUCTUATIONS.

Standard Copper (cash).

		£ s. d.	
Mar.	23 ..	33 1 3	inc. 5/–
,,	24 ..	32 15 0	dec. 6/3
,,	29 ..	31 17 6	,, 17/6
,,	30 ..	31 12 6	,, 5/–

Electrolytic Copper.

		£ s. d.	
Mar.	23 ..	36 10 0	No change
,,	24 ..	37 0 0	inc. 10/–
,,	29 ..	35 0 0	dec. 40/–
,,	30 ..	35 0 0	No change

Standard Tin (cash).

		£ s. d.	
Mar.	23 ..	128 10 0	inc. 15/–
,,	24 ..	126 7 6	dec. 42/6
,,	29 ..	118 2 6	,, 165/–
,,	30 ..	120 10 0	inc. 47/6

Tin (English ingots).

		£ s. d.	
Mar.	23 ..	129 15 0	inc. 15/–
,,	24 ..	127 15 0	dec. 40/–
,,	29 ..	119 10 0	,, 165/–
,,	30 ..	122 5 0	inc. 55/–

Zinc Sheets (English).

		£ s. d.	
Mar.	23 ..	24 0 0	dec. 10/–
,,	24 ..	24 0 0	No change
,,	29 ..	24 0 0	,, ,,
,,	30 ..	24 0 0	,, ,,

Spelter (ordinary).

		£ s. d.	
Mar.	23 ..	12 8 9	No change
,,	24 ..	12 5 0	dec. 3/9
,,	29 ..	11 7 6	,, 17/6
,,	30 ..	11 15 0	inc. 7/6

Lead (English).

		£ s. d.	
Mar.	23 ..	14 5 0	inc. 5/–
,,	24 ..	14 0 0	dec. 5/–
,,	29 ..	13 10 0	,, 10/–
,,	30 ..	13 10 0	No change

AVERAGE MONTHLY PRICES OF STEEL SHIP PLATES (NORTH OF ENGLAND).

Year.	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Yearly average.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
1896	5 0 0	5 0 0	5 2 6	5 2 6	5 2 6	5 0 0	5 0 0	5 0 0	5 0 0	5 2 6	5 10 0	5 10 0	5 2 6
1897	5 10 0	5 10 0	5 10 0	5 7 6	5 2 6	5 2 6	5 0 0	5 0 0	5 0 0	5 0 0	5 7 6	5 10 0	5 5 5
1898	5 10 0	5 8 9	5 8 9	5 10 0	5 16 3	5 18 9	5 17 6	6 0 0	6 2 6	6 5 0	6 10 0	6 15 0	5 18 6½
1899	6 15 0	7 0 0	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	7 12 6	7 12 6	7 12 6	7 12 6	8 0 0	7 6 5½
1900	8 0 0	8 0 0	8 2 6	8 5 0	8 7 6	8 7 6	8 7 6	8 0 0	8 0 0	8 0 0	7 10 0	7 0 0	8 0 0
1901	6 15 0	6 15 0	6 5 0	6 0 0	6 0 0	6 0 0	6 0 0	6 5 0	6 7 6	6 5 0	6 0 0	6 0 0	6 4 4
1902	5 17 6	5 12 6	5 15 0	5 15 0	5 15 0	5 15 0	5 15 0	5 15 0	5 15 0	5 15 0	5 15 0	5 10 0	5 14 7½
1903	5 10 0	5 10 0	5 15 0	6 0 0	6 0 0	6 0 0	5 12 0	5 12 6	5 12 6	5 12 6	5 12 6	5 10 0	5 13 11
1904	5 7 6	5 10 0	5 12 6	5 12 6	5 12 6	5 12 6	5 12 6	5 12 6	5 12 6	5 12 6	5 12 6	5 12 6	5 11 10
1905	5 15 0	5 17 6	5 17 6	5 17 6	5 17 6	5 17 6	5 17 6	5 17 6	6 0 0	6 10 0	7 0 0	7 0 0	6 2 3½
1906	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 10 0	7 0 10½
1907	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 0 0	7 0 0	7 8 4
1908	6 10 0	6 10 0	6 10 0	6 5 0	6 5 0	6 5 0	6 0 0	6 0 6	6 0 0	6 0 0	6 0 0	6 0 0	6 3 9
1909	6 0 0	6 0 0	6 0 0	6 0 0	6 0 0	5 15 0	5 15 0	5 15 0	6 0 0	6 0 0	6 0 0	6 0 0	5 18 9
1910	6 5 0	6 5 0	6 7 6	6 10 0	6 10 0	6 10 0	6 10 0	6 10 0	6 10 0	6 15 0	6 15 0	6 15 0	6 10 2
1911	6 15 0	6 15 0	6 15 0	6 15 0	6 15 0	6 15 0	6 15 0	6 15 0	6 15 0	6 15 0	6 15 0	6 18 4	6 15 3½
1912	7 3 9	7 5 0	7 5 0	7 12 6	7 15 0	7 15 0	7 15 0	8 0 0	8 0 0	8 0 0	8 2 0	8 5 0	7 14 10
1913	8 5 0	8 5 0	8 5 0	8 5 0	8 5 0	8 5 0	8 5 0	7 19 0	7 15 0	7 3 0	6 15 0	6 10 0	7 16 5½
1914	6 10 0	6 10 0	6 10 0	6 10 0	6 10 0	6 0 0	6 0 0	7 0 0	7 5 0	7 5 0	7 6 3	7 10 0	6 14 8½
1915	8 0 0	8 10 0	9 0 0	9 10 0	9 10 0	10 0 0	10 0 0	10 0 0	10 0 0	10 0 0	10 5 0	11 0 0	9 12 11
1916	11 7 6	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 9 2
1917	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0
1918	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0
1919	11 10 0	14 0 0	14 0 0	14 0 0	17 0 0	17 7 6	17 15 0	18 5 0	18 5 0	18 5 0	19 12 6	21 5 0	16 15 5
1920	22 10 0	23 10 0	23 10 0	28 10 0	23 10 0	23 10 0	23 10 0	23 10 0	24 0 0	24 10 0	24 5 0	24 5 0	23 13 4
1921	23 5 0	22 10 0	20 4 0	19 0 0	19 0 0	17 0 0	15 0 0	14 15 0	13 12 0	12 5 0	10 10 0	10 10 0	16 9 3
1922	10 10 0	10 10 0	10 10 0	10 10 0	10 10 0	10 4 0	10 0 0	9 7 6	9 4 0	9 5 0	9 5 0	9 5 0	9 18 4½
1923	9 7 6	9 15 0	10 5 0	10 10 0	10 10 0	10 10 0	9 18 9	9 17 6	9 17 6	9 17 6	9 18 6	10 6 10½	10 1 2½
1924	10 1 6	9 18 1½	9 17 6	9 17 6	9 17 6	9 19 4½	10 5 0	10 5 0	10 5 0	9 19 0	9 15 0	9 15 0	9 19 7½
1925	9 14 0	9 10 0	9 10 0	9 1 3	9 0 0	9 0 0	8 17 0	8 13 1½	8 7 6	8 5 6	7 16 3	7 14 3	8 15 8½
1926	7 12 2½	7 12 6	7 12 6	7 14 4½	7 15 0	7 16 10½	8 2 6	8 2 6	8 4 0	8 12 6	8 12 6	8 16 3	8 1 1½
1927	8 17 6	8 17 6	8 11 6	8 7 6	8 6 3	8 5 0	8 5 0	8 3 9	8 2 6	8 2 6	8 5 0	8 5 0	8 7 5
1928	8 2 6	8 5 0	8 7 6	8 7 6	8 7 6	8 7 6	8 7 6	8 7 6	8 7 6	8 7 6	8 7 6	8 7 6	8 6 10½
1929	8 7 6	8 7 6	8 7 6	8 7 6	8 10 6	8 12 6	8 12 6	8 12 6	8 12 6	8 12 6	8 12 6	8 13 9	8 10 9½
1930	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0
1931	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0
1932	8 15 0	8 15 0	—	—	—	—	—	—	—	—	—	—	—

WILLIAM JACKS & COMPANY,

WINCHESTER HOUSE, OLD BROAD ST., LONDON, E.C.2.

CLARENCE CHAMBERS, 39, CORPORATION STREET, BIRMINGHAM.

13, RUMFORD STREET, LIVERPOOL.

PIG IRON

REGISTERED TRADE MARK

All grades FOUNDRY, HEMATITE, BASIC, SPECIALS, &c.

NON-FERROUS METALS

COPPER, TIN, LEAD, SPELTER, ANTIMONY, CHROME ORE.

WILLIAM JACKS & COMPANY,

19, ST. VINCENT PLACE, GLASGOW.

ZETLAND ROAD, MIDDLESBROUGH.

SMALL ADVERTISEMENTS.

Notice.

Small Advertisements in this section of the Journal are accepted at the prepaid rate of 6d. per line, first line in capitals counting two, average 6 words per line. Minimum charge for one insertion 3/-

(A remittance should accompany instructions.)

SITUATIONS WANTED.

PATTERNMAKER - DRAUGHTSMAN, aged 23, secondary education, seeks progressive post in modern foundry. Experience includes 5 years in engineering and automobile patternshops, followed by over 2½ years in D/O of prominent machine-tool makers (present position).—Box 134, Offices of The Foundry Trade Journal, 49, Wellington Street, Strand, London, W.C.2.

YOUNG Foundry FOREMAN desires change to improve position; age 29; iron, bronze, aluminium; first-class references.—Box 142, Offices of The Foundry Trade Journal, 49, Wellington Street, Strand, London, W.C.2.

EMPLOYMENT REGISTER.

Conducted by the Institute of British Foundrymen by courtesy of the proprietors of The Foundry Trade Journal.

Correspondence should be addressed to the General Secretary, Institute of British Foundrymen, St. John Street Chambers, Deansgate, Manchester, from whom full particulars can be obtained of this service.

Any employer wishing to communicate with a candidate should write to the General Secretary, quoting identification number.

EXPERIENCED and well-known Foundry Manager is open to consider new engagement. Has had complete control of large foundries engaged in all branches of ironfoundry work, from small repetition work to castings of 50 tons. (168)

FOUNDRY Manager seeks re-engagement: 25 years' first-class experience on highest-class iron and brass castings, including pumps, cranes, and repetition work. Good technical knowledge. Age 49. (169)

PATENTS AND TRADE MARKS.

PROTECT YOUR IDEAS.—Free, "Advice Handbook" on patenting inventions and registering trade marks by Registered Agent with 45 years' experience.—Kings Patent Agency, Limited, 146a, Queen Victoria Street, E.C.4.

PROPERTY.

MAGNIFICENT

11 ACRES WORKS SITE.

SHEFFIELD.

145,000 Sq. Ft. of Shops.

SIDING CONNECTIONS

with L.M. & S. and L. & N.E. Rlys.

WELL-BUILT & COMMODIOUS OFFICES

Will Sell whole or in lots to suit customers or Let on favourable terms. Unique opportunity for Manufacturers.

Apply—

THOS. W. WARD, LTD.,
ALBION WORKS, SHEFFIELD.

PUBLICATION.

RYLAND'S DIRECTORY of the Coal, Iron, Steel, Tinplate, Metal, Engineering, Hardware and Allied Trades. 1932 edition. Now ready. Price 42s., bound in cloth.—Industrial Newspapers, Ltd., 49, Wellington Street, Strand, London, W.C.2.

MACHINERY.

"BRISTOL" Air Compressor, capacity 44 c.f. per min., with fast and loose pulley, also Automatic Air Unloader and Riveted Air Receiver, 5 ft. 0 in. x 2 ft. 0 in. dia., with safety valve, etc. Pneumatic Rammer and "Coleman" Plain Jar Ramming Machine, with table about 15 in. x 20 in. All new August, 1931. Used 5 hrs. Cost £115. What offers?—Apply, Box 138, Offices of The Foundry Trade Journal, 49, Wellington Street, Strand, London, W.C.2.

NEARLY new Sandblast Room Plant; 8-ft. sq. room, V2 separator and cyclone, vertical compressor, fan and usual equipment; installed 1931, very little used; can be seen working.—Box 140, Offices of The Foundry Trade Journal, 49, Wellington Street, Strand, London, W.C.2.

WHEEL Moulding Machines. One each 4 ft. 6 in., 5 ft. 0 in. and 6 ft. 0 in. Machines, new, to be sold at much-reduced prices.—Write for particulars, Buckley & Taylor, Limited, Oldham.

THOS. W. WARD, LTD.

2 Massey 3-cwt. Pneumatic Power Hammers.

3 Geared Foundry Ladles, carriers 3′ 7″ x 3′ x 3′ 9½″.

11½″ x 8½″ Cap. Hack Sawing Machine.

4″ "Winn" Pipe Screwing Machine.

3′ 9″ "CARR" TYPE DISINTEGRATOR.

OVOID-MAKING ROLLS, 2½″ x 2″ ovoids.

"IDEAL" BALL MILL, casing 6′ 0″ dia.

New COCHRAN BOILER, 12′ 3″ x 5′ 6″, 100 lbs. press.

2,000′ 1½″-dia. S. & S. PIPING.

ALBION WORKS, SHEFFIELD.

"Albion" Catalogue on application.

X

Are you interested in a

Compressed Air Moulding Machine

capable of turning out 120 moulds per hour in boxes 13″ × 17″ and which only costs £75 delivered London, duty paid?

Write to:—

ARTHUR LENTZ & CIE,
Giessereimaschinenfabrik,
DÜSSELDORF (Germany).

Agents and manufacturers in Great Britain Wanted!

X

MISCELLANEOUS.

LINSEED OIL and LINSEED OIL FOOTS. Advertisers have for sale large quantities of these materials at 10 per cent. under to-day's market prices—guaranteed Genuine Linseed Oil and Linseed Oil Foots.—For further particulars and prices write, Box 130, Offices of The Foundry Trade Journal, 49, Wellington Street, Strand, London, W.C.2.

'Phone: 287 SLOUGH

LADLES—GEARED

12-Ton "Stevenson"	... ...	£48
9-Ton "MacNeil"	... ...	£42
6-Ton "Thwaites"	... ...	£34
4-Ton "Evans"	... ...	£28
2-Ton "Evans"	... ...	£19

PNEUMATIC SQUEEZERS

14″×16″ Mumford split pattern 2 @ £35
16″ × 16″ "Coventry" jolt squeezers ... ... 2 @ £35
14″×16″ Tabor split pattern ... 1 @ £35

ABOVE ARE AS NEW.

BUY FROM ME AND SAVE MONEY!

Alex. HAMMOND, *Foundry Machinery Merchant,*
14, AUSTRALIA ROAD, SLOUGH

NICKEL
CHROMIUM
VANADIUM
TITANIUM, ETC.

Bradley's

REFINED
ALLOY PIG IRONS

WE have available a new range of compositions containing varying proportions of Nickel, Chromium, Vanadium, Titanium, etc., specially suitable for high duty castings required to withstand high temperature and corrosion.
THE USE OF ALLOY ADDITIONS ENSURES UNIFORM STRUCTURE AND GREATER RESISTANCE TO WEAR.

BRADLEY & FOSTER LIMITED
DARLASTON, STAFFS

Telephone: Darlaston 16 (P.B. Ex.) Telegrams: "Bradley's, Darlaston."

PETER—WITH ONE EXCEPTION

With one exception Peter is an ordinary little fellow. Chubby, likeable, just five-and-a-half, full of life and fun, and on occasions—be it admitted—of naughtiness. Just now Peter's rather important, for this is his first term at school, and he's grappling with the intricacies of "A B C" and "Twice-Two": difficult subjects to all men of five-and-a-half, but even more difficult in Peter's case because—bad luck—he's totally blind. That's his One Exception. Peter learns reading, writing, and 'rithmetic through the medium of "Braille"—dull stuff compared with the coloured picture books of most five-and-a-halfs. However, he's a stout lad is Peter, and he's making great progress.

Would you like to know more about him? How, in spite of his "One Exception," he is being educated and, when older, technically trained and usefully employed.

There is a long waiting list of "Peters" throughout the British Isles, for whom training and accommodation must be provided in the immediate future.

Will you help with a donation or annual subscription? Any sum, large or small, will be gratefully received.

Here's a suggestion. Your eyesight is worth 3d. a year to you. Send Peter and his handicapped pals 3d. for every year you've had it. Now, please, in case it slips your memory. Good idea?

The Chairman,

SCHOOL FOR THE BLIND
(Founded 1838)
SWISS COTTAGE, LONDON, N.W.3